The TOOL ENGINEER

TECHNOLOGY DEPT.
PUBLIC LIBRARY
APR 8 - 1940
DETROIT

HARDINGE BROTHERS, Inc., ELMIRA, N. Y.
CHICAGO NEW YORK HARTFORD PHILADELPHIA CLEVELAND DETROIT
1890 — HARDINGE GOLDEN ANNIVERSARY YEAR — 1940

Official Publication of the
AMERICAN SOCIETY OF TOOL ENGINEERS

ACCURACY

speeds up the modern kitchen

FAR cry from the old wood stove is the modern electric range. On the market now for several years, it was at first bulky, slow, prohibitively expensive . . . a luxury for a narrowly limited class of people. But today any of your neighbors could start right in to enjoy the cool, rapid cooking of the modern inexpensive, efficient electric range. Accuracy makes the difference, as it does in so many branches of human activity. Accuracy—machine tool accuracy to ten-thousandths of an inch at high speeds—has lowered costs, increased production, remade the civilized world.

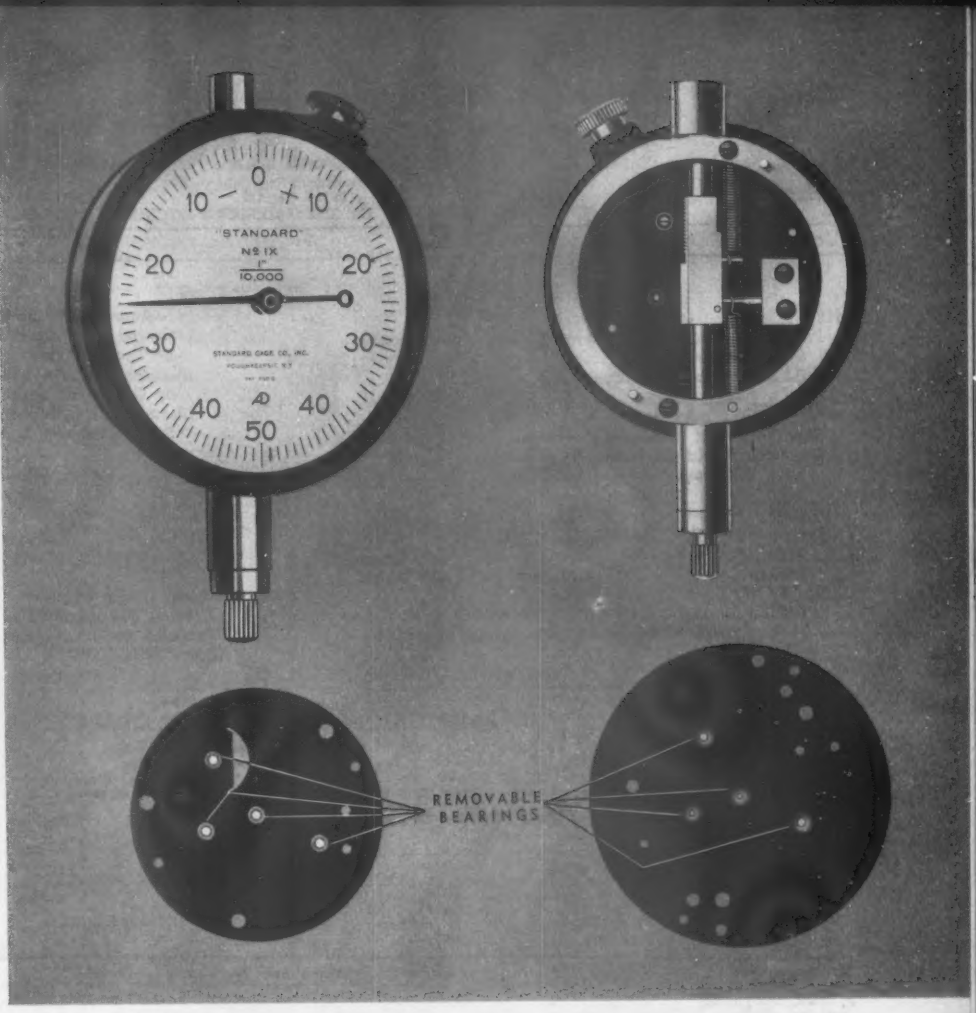
There is no end in sight. At Pratt & Whitney today there are over 2,600 skilled craftsmen reaching out, by means of this principle of accuracy, to improve the world's status far beyond present standards. The machine tools, cutting tools, and gages P & W craftsmen make can often work wonders even in plants where production accuracy is already thought to be at its peak. When you buy, investigate Pratt & Whitney equipment. It pays big dividends.

PRATT & WHITNEY

Division **Niles-Bement-Pond Company · Hartford, Connecticut, U. S. A.**

Mention "The Tool Engineer" to advertisers

STANDARD AGD DIAL INDICATORS WITH SHOCKPROOF MECHANISM AND REMOVABLE GEAR BEARINGS



STANDARD

DIAL INDICATORS

STANDARD Dial Indicators are now furnished to the American Gage Design Specifications covering basic mounting dimensions approved and adopted by the AGD Committee in June 1939. This feature is of considerable value from a standpoint of interchangability for use on machines, fixtures, etc.

In addition to this several new and noteworthy features have been incorporated by STANDARD and are briefly listed below:

Shockproof Mechanism is contained within the body of the Indicator which protects the gear unit from any undue shock against the contact point. In constant use on fast inspection retains its accuracy through long service.

Bearings for all pinions and gears as well as spindle bearings are replacable, which reduces repair cost. Selected bearing-material for long life.

Spindle is of stainless steel, hardened, ground and lapped.

Face of gear teeth reduced to minimize friction and produce the smooth action essential for accurate measuring.

Circular on request.

STANDARD GAGE COMPANY, inc.

80 PARKER AVE. **POUGHKEEPSIE, N. Y.**

The Tool Engineer

Trademark Registered in U.S. Pat. Off.

OFFICIAL PUBLICATION OF THE AMERICAN SOCIETY OF TOOL ENGINEERS

Vol. VIII APRIL, 1940 No. 12

Contents

NEWS

Production Perspectives—News of Mass Manufacturing from Everywhere 36
A.S.T.E. Doings, By George J. Keller 38

GENERAL

New York Tool Engineers' Meeting, Highly Successful 9
Our Society and Our Industry—Past-Present-Future, By J. R. Weaver 11

TECHNICAL

Symposium—ECONOMICS OF TOOLING
Importance of Production Planning, By B. G. Tang 12
Tooling Large Products—Large and Small Quantities, By W. T. Stegemerten 13
Tooling Large Products—A Discussion, By J. M. Crawford 17
Tooling Small Products—Large and Small Quantities, By F. E. Darling 18
Tooling Small Products—A Discussion, By W. J. Peets.... 20
Symposium—PRECISION SMALL GEARS
Industrial Requirements of Precision Small Gears, By Thomas Turner 21
Discussion on Shaping Method of Production Small Gears, By George H. Sanborn 23
Discussion on Hobbing Methods of Producing Precision Small Gears, By S. N. Ransome 27

EDITORIAL

A Problem and Its Solution, By A. E. Rylander 7

A.S.T.E.

National Officers, National Executive Committee, 1940-41..... 10
A.S.T.E. Doings 38
April Chapter Meetings 58

FEATURES

Handy Andy Says— 44
Looking Around, By Perry Scope 64
Personal Service Column 78

ADVERTISERS' INDEX 86

CLASSIFIED ADVERTISING 78

A. H. d'Arcambal, President

AMERICAN SOCIETY OF TOOL ENGINEERS

2567 W. Grand Blvd., Detroit, Mich.

Ford R. Lamb, Executive-Secretary

E. W. Dickett, 1st Vice-President — F. R. Crone, Treasurer

E. O. Rutzen, 2nd Vice-President — C. O. Hersam, Secretary

Board of Directors—1940-41

Louis Biehler	Herbert D. Hall	Benjamin A. Page	Charles W. Thiede
Arthur B. Bok	G. J. Hawkey	Gordon L. Reed	Arnold Thompson
Frank R. Crone	Stanley S. Johns	Otto Reller	Walter Wagner
Charles E. Codd	Earl V. Johnson	Eldred A. Rutzen	James R. Weaver
C. B. Cole	George C. Johnson	George A. Smart	Louis L. Weber
E. A. Doogan	John R. Lynch	Charles F. Staples	James P. Wiley
J. A. Elwood	A. H. Mitchell	John A. Strecker	Otto W. Winter
E. W. Ernest	Ray H. Morris	E. M. Taylor	George W. Wise

National Committee Chairmen

Industrial Relations W. F. Wagner	**Standards** E. W. Ernest	**Historian** O. B. Jones
New Chapters R. T. Bramson	**Editorial** I. F. Holland	**Constitution and By-Laws** R. M. Lippard
Membership C. B. Cole	**Publicity** Louis L. Weber	**Educational** H. D. Hall

Chapter Chairmen and Secretaries 1940-1941

Baltimore: Nils H. Lou, Chairman; Carl A. Larsen, Secretary, % Glenn L. Martin Co., Baltimore, Maryland.

Buffalo: George J. Keller, Chairman; Alfred Cotesworth, Secretary, Columbus-McKinnon Chain Corp., Buffalo, New York.

California Chapter at Los Angeles: Louis Biehler, Chairman; Merton W. Seavey, Secretary, Lockheed Aircraft Corporation, Los Angeles, California.

Chicago: Clarence E. Cook, Chairman; Fred J. Schmitt, Secretary, D. A. Stuart Oil Co., Chicago, Illinois.

Cincinnati: W. J. Frederick, Chairman; W. D. Averill, Secretary, Sales Engineer, Cincinnati Milling Machine and Grinder Company, Cincinnati, Ohio.

Cleveland: C. V. Briner, Chairman; Wm. Reiff, Jr., Secretary, Cleveland Duplex Machinery Co., Cleveland, Ohio.

Dayton: George Goodwin, Chairman; Howard McMillen, Secretary, Frigidaire Division, G.M.C., Dayton, Ohio.

Detroit: Clyde L. Hause, Chairman; Clyde Mooney, Secretary, Pioneer Engineering & Mfg. Co., Detroit, Michigan.

Elmira: J. R. Blank, Chairman; E. J. Carlton, Secretary, Ingersoll-Rand Co., Elmira, New York.

Golden Gate: Carl W. Horack, Chairman; Walter Kassebohm, Secretary, % Marchant Calculating Machine Co., Oakland, California.

Hartford: Frederic L. Woodcock, Chairman; Richard O. Miller, Secretary, % Underwood Elliott Fisher Co., Hartford, Connecticut.

Houston: Floyd E. Doty, Jr., Chairman; Louis M. Krausse, Secretary, % Krausse Mfg. Tool Co., Houston, Texas.

Milwaukee: Harold L. Heywood, Chairman; Julius A. Riedl, Secretary, % Seaman Body Corp., Milwaukee, Wisconsin.

(Moline) Tri-Cities: Joseph B. Morganthall, Chairman; W. Z. Fidler, Secretary, % Reynolds Engineering Co., Rock Island, Illinois.

New York-New Jersey: W. T. Gray, Chairman; Ben C. Brosheer, Secretary, % American Machinist, New York, N. Y.

Ontario: Arnold Thompson, Chairman; Leonard G. Singer, Secretary, % Williams & Wilson, Ltd., Toronto, Ontario, Canada.

Peoria: Joseph L. Berry, Chairman; Joe B. Nims, Secretary, % National Aluminum Mfg. Co., Peoria, Illinois.

Philadelphia: John A. Strecker, Chairman; John W. Materne, Secretary, 1626 North 28th Street, Philadelphia, Pa.

Pittsburgh: W. B. Pierce, Chairman; E. D. Gangwere, Secretary, % Westinghouse Electric & Manufacturing Company, Pittsburgh, Pa.

Racine: Adolph Zaborowski, Chairman; Norman K. Helding, Secretary, % Modine Mfg. Co., Racine, Wisconsin.

Rochester: John C. Dense, Chairman; Milton L. Roessel, Secretary, % Eastman Kodak Camera Works, Rochester, New York.

Rockford: Kenneth W. Lund, Chairman; R. E. Meili, Secretary, % Burd Piston Co., Rockford, Illinois.

Schenectady: F. J. Diehl, Chairman; D. G. Saurenman, Secretary, 6 North Toll St., Scotia, N. Y.

South Bend: E. B. Barber, Chairman; Hale W. Parrish, Secretary, % Parrish Machine Company, South Bend, Ind.

Springfield: Frank W. Curtis, Chairman; K. T. Miller, Secretary, % K. Miller Tool & Mfg. Co., Inc., Springfield, Mass.

St. Louis: D. D. Burnside, Chairman; Clarence Miller, Secretary, % Measuregraph Co., St. Louis, Mo.

Twin Cities: George W. Wise, Chairman; Herman L. Seaberg, Secretary, % Farwell, Ozmun, Kirk & Company, Minneapolis, Minn.

Syracuse: Charles T. Allen, Chairman; Willard E. Parish, Secretary, % Crouse Hinds Co., Syracuse, N. Y.

Toledo: Lorence E. Rennell, Chairman; Rolland H. Mogle, Secretary, % The Electric Auto-Lite Co., Toledo, O.

Worcester: Raymond A. Cole, Chairman; Charles A. Banks, Secretary, % Heald Machine Co., Worcester, Mass.

(York) Central Pennsylvania: Ray Wentzler, Chairman; M. G. Leeson, Secretary, % York Ice Machinery Co., York, Pa.

Application blanks and information pertaining to membership in the American Society of Tool Engineers may be had by addressing The Tool Engineer, 2842 W. Grand Boulevard, Detroit, Michigan, or the Secretary's office, 2567 W. Grand Blvd., Detroit, Michigan. Dues are $5 initiation fee, $6 per year for senior grade membership and $3 per year for junior grade membership. Junior membership initiation fee $2.

The Tool Engineer is published the first Thursday of each month. It is the official publication of the American Society of Tool Engineers, Incorporated. The membership of the Society and readers of this publication are practical manufacturing executives such as master mechanics, works managers, Tool Engineers, tool designers and others who are responsible for production in mass manufacturing plants throughout the nation and in some foreign countries.

Owing to the nature of the American Society of Tool Engineers, a technical organization, it cannot, nor can the publishers be responsible for statements appearing in this publication either as papers presented at its meetings or the discussion of such papers printed herein.

MEMBER OF CONTROLLED CIRCULATION AUDIT, INC.

Published by
THE BRAMSON PUBLISHING CO.
2842 W. Grand Boulevard MAdison 7553 Detroit, Michigan
Roy T. Bramson, Publisher and Editor

ADVERTISING OFFICES

Chicago, Illinois	New York City	Providence, R. I.
Dwight H. Early	A. M. Willcox	Herman T. Pierik
100 N. LaSalle Street	420 Lexington Avenue	4 Weybosset Street
CENtral 4158	Lexington 2-4816	GAspee 1568

Copyright 1940 by The Bramson Publishing Company

Printed in the United States of America

UNFAILING

PERFORMANCE

IN EVERY SINGLE HOLO-KROME SCREW
Is Our Guarantee to You

FIBRO FORGED Socket Screws—the Screws that **are** COMPLETELY Cold Forged by the patented method whereby not only the exterior of the screw is forged but the actual socket, the side walls, the head, and every particle of the screw (threads excepted) is Completely Cold Forged.

Quality, Precision and the exclusive Lustrous Black Finish—

for Unfailing Performance, *specify Holo-Krome*

HK **HOLO-KROME**

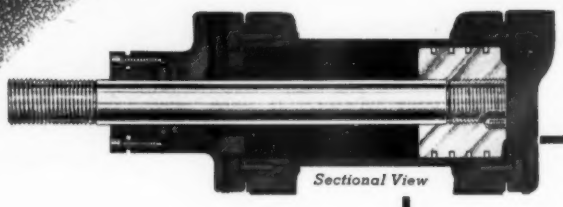
fibro forged

TRADE MARK

THE HOLO-KROME SCREW CORP. **SOCKET SCREWS** HARTFORD, CONN. U.S.A.

SIMPLER HYDRAULIC CYLINDER DESIGN

means High Efficiency Power



Sectional View

The advantages of smooth-acting, accurately controlled hydraulic power are easier to obtain with Hannifin hydraulic cylinders. Their patented design assures high efficiency operation, greatly simplifies application, and presents an improved appearance. Minimum fluid slip, with consequent efficient performance, is the direct result of Hannifin design and construction.

NO TIE RODS This simple design, originated by Hannifin, is stronger and eliminates a source of leakage. Mountings are simplified, and end caps may be removed without collapse of other parts of the assembly.

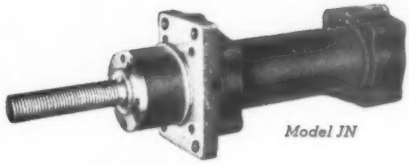
UNIVERSAL CAPS Either end cap may be positioned independently, so that inlet port is at top, bottom, or either side. Either cap may be moved without disturbing cylinder mounting or any other parts. Installation and piping are frequently simplified.

AIR VENT PLUGS Each end cap has air vents on three sides. With the inlet port at either side or bottom, there is always an air vent plug at the top.

LEAK-PROOF Special mirror finish honing produces a straight, round, perfectly smooth cylinder bore, affording high efficiency piston seal and minimum fluid slip.

MANY TYPES AND SIZES Built in many standard mounting types, with small diameter piston rod, 2 to 1 differential piston rod, or double end piston rod, in all sizes, for working pressures up to 1000 and 1500 lbs. per sq. in. Furnished with or without cushion. Other types built to order, any size, for any pressure. Write for Bulletin 35 with complete specifications of all types.

Model CN



Model JN

Model EN

Model HN

Other Mountings Available

HANNIFIN MANUFACTURING COMPANY

621-631 South Kolmar Avenue • Chicago, Illinois

ENGINEERS • DESIGNERS • MANUFACTURERS • Pneumatic and Hydraulic Production Tool Equipment

Detroit Representative: **R. A. Bean, Hayward Building, 4829 Woodward Ave. Telephone Columbia 4949**

HANNIFIN

HYDRAULIC CYLINDERS

A PROBLEM and Its SOLUTION!

AN EDITORIAL BY

A. E. RYLANDER

FOR the past several years, well intentioned reformers have tried to create an Utopia, of a land heretofore populated by a virile, independent, self reliant and, on the whole, a law abiding people. The past tense implied does not presume that these qualities have degenerated, but, a changing concept of things-as-they-ought-to-be inclines one to the belief that we are in a period of moral and spiritual as well as economic recession. All this, of course, is in direct contrast to technical and material progress, now at a level previously undreamed of. The assumption is, then, that the visionary and the practical are not pulling together. Let us see.

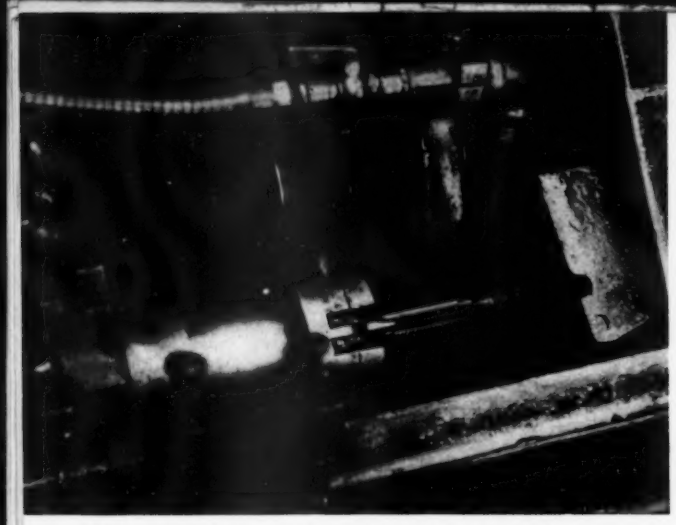
Among major social problems are: (1) Mounting juvenile crime and delinquency, with the age of offense steadily dropping. (2) A growing dependent class, not necessarily criminal, but, since it does not contribute to the progress of the nation, just as dangerous to its future as the criminal class. Because, the criminal is largely recruited from the idle, and both must be supported by the state, which, in the final analysis, means support by a diminishing independent class. (3) A widening class division in which the (fortunately) still solid middle class fails to bridge the gap between extremes, and, (4) political dishonesty, by which is meant that many office holders, instead of legislating or working for social and economic improvement, straddle or evade vital issues in their desire for votes. One could, of course, add to the list, but the items mentioned may be considered inclusive; anything added would be but subdivisions of the four. And the four are inter-related, as matured reflection will show.

Various causes have been advanced for this state of affairs, and minorities, each with its own nostrum, have tried to force the cure down the throats of an unwilling patient. Unwilling, because the diagnosis has not reconciled cause and effect nor the medicine hit the spot. The trend of social reform has been to cure the effect without consideration of basic causes. Occasionally, however, clear sighted thinkers advance the basic truth that the major cause for our social and economic ills is idleness, and that the cure is work. We will, here, reconcile this analysis with a concrete example.

A large eastern manufacturer of machine tools, (Brown & Sharpe, to be exact) has recently issued a booklet in which is listed its "apprentice graduates." It is but a partial list, includes some eight hundred men whose present occupations and addresses are known. But, the roster includes men who have scaled high on the industrial and engineering ladders, includes prominent members of the American Society of Tool Engineers. Scanning the list, one reads after the names: toolmaker, diemaker, supervisor, subforeman; instructor, draftsman, tool designer, engineer; department foreman, superintendent, works manager, president. The type of hard headed, practical and practically trained plus men that, as a class, has characterized the membership of the A.S.T.E. These men have either arrived or they are on the way; not one has become a social or economic problem because each has had his social and economic genesis rooted deep in the soil of work . This listing, of apprentice graduates, is an honor roll as bright as any cherished by a major university.

The majority of these men (and the list is but typical of apprentice graduates in various fields) started their courses at an age when our modern youngsters are still going to school and without a definite objective nor guarantee that one will be achieved even if decided upon. The easy dollar, legislated ease and guild restrictions have all combined to discourage apprentice training, excluding many who would take the practical road to success. Lack of objective, and the grinding out of classical graduates on a pattern of sameness, together with the uncertainty engendered of too much "book learning" without enough opportunity to apply it, makes for unrest among the young. And as the saying goes, Satan finds work for idle hands.

Now, if under known conditions (such as we have experienced) the state can produce substantial, independent and self supporting citizens, why experiment further with innovations that only lead us astray? The avenues of advancement have not been destroyed, it's just that, as a people, we are being shunted into dangerous detours. It is entirely fallacious to say that the machine has reduced opportunities for work, rather, it may be said that it has reduced some while creating an infinitely wider variety and a far wider field. A list of eight hundred apprentice graduates, many of whom are now prominently employed in industries that were unknown when they were graduated, is proof of widening opportunity. It is also proof that manual skill—work with the hands—is as conducive to leadership, if backed by technical or specialized training, as any degree conferred by a college. There are few colleges, conferring classical degrees, that can show as many successful men, proportionately, as those of our industries that train apprentices in the skilled crafts. The royal road to success is built by work, and the sooner we come back to a realization that work with the hands is honorable and conducive to success the better for all concerned. Provide work, and the incentive of result, and our social and economic problems will solve themselves.



Machines of this type, designed by G. T. D. Greenfield's own engineers, grind threads with minimum lead error and to extremely close size tolerances.

Even cut-thread carbon taps are threaded by machines that automatically feed, thread and size.

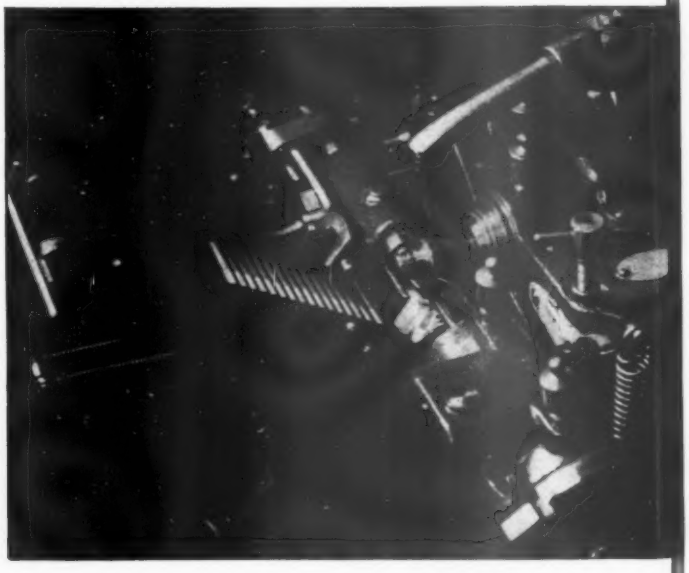
ACCURATE TAPS REDUCE COSTS

How G. T. D. Greenfield's modern machinery makes closer tolerances possible

More taps wear out (i. e. wear undersize) than ever break. In terms of tap tolerances, this means that a tap near the "low" limit may produce only a fraction of the finished holes tapped by one near the high limit. To give users a greater average production per tap, Greenfield has developed super-accurate machinery which permits a closer size control than required by standard tap tolerances.

Heat treatment is vital, too. Typical of Greenfield research and leadership here is "Maxi" heat treatment, responsible for amazing performance in threading abrasive or stringy metals.

As the world's largest manufacturer of threading tools, G. T. D. Greenfield has outstanding opportunities to study performance and give its many thousands of customers all over the world the benefit of that wide experience. Call in the Greenfield engineer.



(*Right*) The right shape and depth of flute are very important in developing fine cutting qualities and reducing tap breakage.

(*Below*) This comparator helps to insure correct thread form, which contributes to both accuracy and long tap life.

Greenfield Tap & Die Corporation · Greenfield, Mass.

Detroit Plant: 2102 West Fort St.
Warehouses in New York, Chicago, Los Angeles and San Francisco
In Canada: Greenfield Tap & Die Corp. of Canada, Ltd., Galt, Ont.

GD GREENFIELD

TAPS · DIES · GAGES · TWIST DRILLS · REAMERS · SCREW PLATES · PIPE TOOLS

NEW YORK ANNUAL MEETING — HIGHLY SUCCESSFUL

TAKEN from any standpoint — total registration, the unmistakable enthusiasm of those attending, the kind and nature of the technical subjects covered, the discussions of the various technical subjects and the good fellowship and seriousness manifest throughout the three days, proved conclusively that the Annual Meeting of the American Society of Tool Engineers, March 7, 8 and 9, was the most successful meeting of its kind ever to be held. Considering that the meeting, necessarily, came at a time when Tool Engineers are extremely busy and much needed in their home plants and machine shops throughout the nation, the total of those actually registering, standing at approximately 650, is of itself a record. That the young and very rapidly growing American Society of Tool Engineers is "going places" was plainly evident in the intenseness of interest shown by the participating membership and guests, in the eight technical sessions embracing some thirty authoritative speakers, as well as in the very serious deliberation of the Board of Directors, composed of the executive officers and chapter chairmen.

At the annual dinner on Friday evening, March 8th, nearly 600 people heard retiring president, James R. Weaver, deliver an address on "Our Society and Our Industry— Past, Present and Future". A complete transcript of this important address is given elsewhere in this issue.

Sworn in at this annual dinner meeting were the new officers for this year, A. H. d'Arcambal, Pratt & Whitney Division, Niles-Bement-Pond Company, Hartford, Conn., as president. As first vice president, Edward W. Dickett, Proposal Engineer, Sundstrand Machine Tool Company, Rockford, Illinois; second vice president, Eldred O. Rutzen, Chief Tool Designer, Cutler Hammer Company, Milwaukee; secretary, Conrad O. Hersam, Consulting Tool Engineer, Philadelphia; and treasurer, Frank R. Crone, Chief Tool Designer, Lincoln Motor Car Company, Detroit. Ford R. Lamb was re-elected Executive Secretary of The Society. Announcement was also made that the Semi-Annual Meeting to be held in October is to be at Cincinnati.

John M. Younger, Professor of Industrial Engineering, Ohio State University, presented the third report of the A.S.T.E. Fact-Finding Committee on the Causes of Unemployment in Industry and their Relation to our Standard of Living.

At the banquet, Conrad Hersam, retiring chairman of the National Membership Committee, presented a loving cup to The Society, which was later awarded by a Board of Judges to the Hartford Chapter for having secured the greatest gain in membership during the past year, under the leadership of its chapter chairman, Ray H. Morris.

At the annual dinner it was also announced that another Machine and Tool Progress Exhibition, similar to the one held in March, 1938 and again in 1939 (and which broke all records for total attendance and scope of an exhibition of that kind) had been voted by the Board of Directors to be again held in Detroit in March, 1941.

Walter F. Wagner, past president of the American Society of Tool Engineers, was appointed by President d'Arcambal to head a committee to publicize the Annual Meeting and Show in Detroit in 1941. Mr. Wagner is at present, Master Mechanic of the Lincoln Motor Car Company, and is one of the early A.S.T.E. pioneers whose ardent support, interest and enthusiasm has helped build The Society to its present prominence. He has been a Director of The Society for several years and served as its president in 1938-39. He has also served The Society as vice-president and chairman of various committees. During his office as president of the A.S.T.E., the 1939 very successful Machine and Tool Progress Exhibition was held in Detroit, where more than 250 exhibitors displayed their machinery, tools and equipment and the total attendance was over 70,000.

Much Credit Due Eastern Chapters

The outstanding success of the 1940 Annual Meeting, including the many splendid technical sessions, the business session and committee meetings, were definite proof of the accomplishments of the Eastern Chapters who arranged and planned the Annual Meeting. Special credit should be given to the New York-New Jersey Chapter and its committees for the excellent handling of the myriad details involved in putting on a meeting of such magnitude and value. To New York-New Jersey A.S.T.Eer, Tom Orchard, and to his committee for their wonderful cooperation and help and to other committees in his chapter are tendered the special thanks of the entire membership. Mr. Orchard, the genial entertainment committee chairman, not only arranged and handled all entertainment features of the program but in his quiet efficient way arranged and managed many other details resulting in the very successful meeting.

There were no exhibits of any kind in connection with this year's National Annual Meeting and the attention and interest of the visiting Tool Engineers was focused almost entirely on the exceptionally well planned educational

(Continued on Page 46)

Highlight of festivities in connection with the Annual National Meeting of the American Society of Tool Engineers, held in New York City, March 7, 8 and 9, was the Annual Dinner, a portion of which is pictured above. Nearly six hundred members and friends, their guests and wives, attended and heard retiring President Weaver and incoming President d'Arcambal review accomplishments and usher in another year of progress to the rapidly growing A.S.T.E.

National Officers

AMERICAN SOCIETY of TOOL ENGINEERS

1940-1941

E. W. DICKETT
First Vice-President

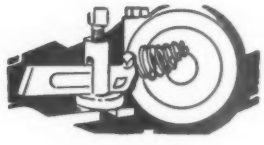
Mr. Dickett moves up to First Vice-President of A.S.T.E. from the position of Second Vice-President. He is a Proposal Engineer with the Sundstrand Machine Tool Company of Rockford, Illinois.

A. H. d'ARCAMBAL
President

Mr. d'Arcambal takes over the reins of the President, being elevated to the high honor by the recent election of the Board of Directors. He served the past year as First Vice-President. "Dark," as he is popularly known to Tool Engineers in all sections of the country, brings to his office a wealth of experience and ability which A.S.T.E. is fortunate to have.

E. O. RUTZEN
Second Vice-President

Former Chairman of Milwaukee Chapter, A.S.T.E., Mr. Rutzen is Chief Tool Designer with the Cutler-Hammer Company in Milwaukee, Wisconsin. For the past several years he has been very active in A.S.T.E. affairs in the Middle West.



F. R. CRONE
Treasurer

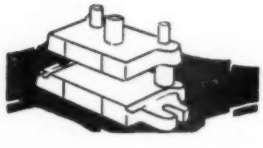
"Frank" has served the Society as Treasurer for the past four years and now enters his fifth year as chief financial officer. He is Chief Tool Designer at the Lincoln Motor Company in Detroit. Mr. Crone has the sincere thanks of the entire Society for his faithful and untiring efforts in administering A.S.T.E. financial affairs.

C. O. HERSAM
Secretary

Conrad O. Hersam, well known to members and friends of A.S.T.E. in every chapter through his untiring efforts in behalf of the National Membership Committee, is now National Secretary. He is a past Chapter Chairman of Philadelphia, where he is a Consulting Tool Engineer.

FORD R. LAMB
Executive-Secretary

Mr. Lamb continues as chief executive in the national offices at Detroit. On his shoulders fall the great responsibilities of conducting and managing the affairs of A.S.T.E., including the mammoth Machine and Tool Progress Exhibition, again scheduled for March, 1941, in Detroit.



National Executive Committee

OUR SOCIETY and OUR INDUSTRY PAST—PRESENT—FUTURE

By
JAMES R. WEAVER
RETIRING PRESIDENT, AMERICAN SOCIETY OF TOOL ENGINEERS
Address at Annual Dinner, New Yorker Hotel, March 8th, 1940

IN a speech on the radio recently the President of the United States said that before speaking on an important occasion he always asks himself the question, "What is there in this situation that hits me right between the eyes?" As I reviewed to myself the eight years of our society's existence and the part Tool Engineers play in manufacturing, to bring to you a "report on the state of the industry" so to speak, I found many things that "hit me right between the eyes."

I was impressed particularly with the grave responsibilities of the Tool Engineer, to industry, and to society. It is the Tool Engineer who gives substance to the ideas of the designer. It is he who must provide manufacturing facilities for hewing and carving from raw materials useful commodities at a cost within reach of a large number of people. But this very function of the Tool Engineer, instead of bringing him acclaim as a public benefactor, makes him the cynosure of legislative, political, and social attacks on all sides.

Tonight you have heard another report of our Fact-Finding Committee to show that machine tools and manufacturing improvements do not create unemployment. We, as Tool Engineers, are particularly interested in the Fact-Finding Committee's report, because if machine tools and improved manufacturing facilities create unemployment, then we are the greatest contributors to the bread lines of America. Our job is to improve manufacturing methods and facilities constantly, so that the costs of commodities are reduced or the efficiencies of products are improved, thus providing better products for the greatest possible number of consumers. Our economic concept is the economy of plenty—not of scarcity. We have many examples in America—the country with the highest standards of living in the world—to show that these improvements in manufacturing facilities actually have created jobs.

Take, as a specific example, the automotive industry, which is by no means the only example. Look what it did to employment: It completely wiped out the buggy-whip business. Back in 1890, when the automobile was born, there were about 177,000 teamsters, draymen, coachmen, and hackmen following the rear ends of horses around. Now there are only 150,000. But that isn't the whole story. There were some 39,000 harness makers at the turn of the century, but only 7500 are engaged in that activity now. At the same time there were about 30,000 people engaged in coach and wagon making. Now there

JAMES R. WEAVER
Retiring President, A.S.T.E.

are only 4,000. The number of blacksmiths has diminished from 215,000 to 121,000. About 13,000 wheelwrights made a tidy living in those days, but the trade is extinct today. Adding them all up, the automobile has abolished around 150,000 jobs in the last 40 years, practically all of them almost independent of machine production. Altogether, perhaps a million people earned their living from some form of highway transportation, excluding traction companies.

To the Editor, *March 12, 1940*

Perhaps it is not polite to argue with a president on his presidential address, but I would like to take the floor for a few minutes to discuss one phase of Mr. Jim Weaver's talk at our annual banquet.

Jim said that no University was training men to be tool engineers. Well it all hinges on the definition of tool engineer, and Jim's own definition is that he is a man trained in the design and operation of tools, jigs, fixtures and dies. Further he knows about the machine tools on which they are used,—their sequence, their machine hour rates, their costs their time study values, their productivity and so forth. Finally they must know something about work planning and work routing and purchasing of new equipment.

Well what Jim describes is an Industrial Engineer, and we have been educating them for ten years and did not know it.

Fact is that Industrial Engineering is the science of manufacturing and the science of manufacturing is the job of the new type of tool engineer.

Incidentally we also educate men for Sales Engineering positions.

We have many men graduating who are combined tool engineers and industrial engineers. We have many more who are good sales engineers; So the Universities — (at least we are) have been giving some thought to this phase of work.

With kind regards,

Yours sincerely,
John Younger
Dept. of Industrial Engr.
Ohio State University

Now look at the credit side of the ledger: The automotive industry has created during the same period 6 million new jobs, according to statistics of the Automobile Manufacturer's Association. Not all of these 6 million are engaged in the actual manufacture of cars, of course. Only about half a million are so engaged; but there are now 3 million truck drivers, and chauffeurs, and laborers in garages, filling stations, traffic signal factories, and accessory shops. The automobile is responsible for 90 per cent of the employment in the gasoline industry, 80 per cent in the rubber industry, 73 per cent in the plate glass industry, 60 per cent in the alloy steel industry, and so on down the line, including the lumber industry and agricultural workers.

Despite overwhelming evidence of this sort, there are several strong factions at work to take us back to the horse-and-buggy days. Recently I read in a booklet called "Ponder", an article entitled "Can Business and Government Co-operate?" by Mordecai Ezekiel, Government Economic Advisor to Secretary Wallace, of the U. S. Department of Agriculture, from which I quote:

"Engineers have created new machines and processes which greatly increase the product from each hour of human labor. That increased productivity should have banished poverty and starvation, and enable everybody to live like kings of old. But instead of higher standards of living, it has meant loss of jobs and loss of self-respect for millions of our citizens.

"The engineer often comes into conflict with the employer. As technician, the engineer wants to make autos or vacuum tubes or houses so good they will last for decades. As businessman, his employer will tell him he can't afford to make them that good—they can't be sold or will close the market for replacements. The engineer often wants to put improved processes into use, which the businessman says won't pay because they will destroy the value of existing plants. The engineer wants to put plant and resources fully at work, expand, employ more, reduce costs, lower prices, widen markets. The business man watches how much can be sold, how profits can be increased.

"Despite the frequent conflict between the engineering and the business viewpoint, both realize that the well-being of society depends on people actively at work, producing and consuming on a high level. One quarter of our city workers are without regular jobs today. Full re-absorption of those unemployed

(Continued on Page 40)

ECONOMICS of TOOLING

A Symposium on the Subject as Given Before a Technical Session, March 7th, 1940 in New York City

NATIONAL ANNUAL MEETING A. S. T. E.

Importance of Production Planning

By

B. G. TANG

GENERAL SUPERINTENDENT
SCHENECTADY WORKS, GENERAL ELECTRIC COMPANY

THE subject of "Economics of Tooling" is a very broad field to be covered by a few technical sessions. The task, however, is not quite as hard as that of the little girl who tried to write a paper on the "Universe and Other Things."

In tooling, 3 different types of production quantity are met. At the low extreme, the finished product may consist of a single unit which is so special that it may never be duplicated, such as Admiral Byrd's "Snow Cruiser," a special mill motor, a special machine tool, or a battleship. In this case, tools are made as simple and inexpensive as possible to serve the purpose.

At the other extreme of the high quantity angle, is the finished product which has reached such a high state of development and such ready acceptance in large quantities by purchasers, that changes are not often necessary, and a number of duplicate sets of tools may be expected to wear out between models. Products of this type include telephones, typewriters, sewing machines, and the like. In this case, the unit cost of tools is generally so low that the finest and most durable tools obtainable are used.

The 3rd type of production lies between these two extremes. It is here, that the ultimate quantities are uncertain, development new, competition keen, and changes frequent. In this case, tooling is very hard to control. The tendency is to make tooling for such products of a more permanent type than is justified by the final quantities of parts produced. As a result, it is often necessary to make difficult and expensive changes in the tooling and possibly to scrap tools which are far from being worn out.

This tendency to overtool can generally be traced to one or more of three causes. First—an overestimate by the sales department of ultimate quantities. Too often the ambitious sales department, in its enthusiasm for a new product, fails to give sufficient consideration to the limits of the market, and the possible activities of competitors. This can easily result in building expensive tools which will add unnecessarily to the unit cost of the product.

A second cause of overtooling may be over-enthusiasm of the product engineer, who fails to anticipate design changes before maximum production is reached. Many changes in new products could be avoided by thorough testing of working models by the product engineer, and closer cooperation between this individual and the Tool Engineer.

A model, made to drawing tolerances and allowances, will disclose where full advantage can be taken of them. It will also show up difficulties such as improper reference surfaces for machining, interference or poor fits between component parts, insufficient stock on castings, and the like. Wooden or plaster models of product parts and of tools or fixtures will often be effective in tool development.

Close contact between the Tool Engineer and the product engineer will avoid many other difficulties. The Tool Engineer can recommend design changes which will simplify the tooling and improve the product. He can keep the product engineer informed as to equipment on hand and new methods and processes available. Too often the product engineer designs apparatus for which production equipment is not on hand and sometimes not in existence. Thus money may be spent unnecessarily for new equipment or for development. However, if the Tool Engineer had been consulted, it may have been possible to design the apparatus to use existing machine tools.

The product engineer can on his part, contribute a full understanding and appreciation of the functions of each part and of the complete assembly. He can keep the factory informed of the service requirements, features of competitive apparatus, and trends in future developments.

A third cause of overtooling may be traced to pride in craftsmanship in the tool department. As we are all aware, the tool department in its zeal to turn out the finest possible tool, is very apt to lose sight of the economics of the situation. Precision and durability have long been the tradition of the toolmaker, but, while accuracy is essential in most cases, the life of a tool should be measured by the requirements of the particular job.

Some individual should resist the tendency to overtool, and certainly the Tool Engineer is in an ideal position to control this. His general knowledge, his association with the sales departments and product engineers, and his natural common sense, best qualifies him for this job.

When the quantities to be made have been definitely determined, a comparative chart may help the Tool Engineer to decide the class of tools to plan. It is hoped that the development of such charts may result from the discussions which are to follow. I will show you an example of a chart such as I have in mind. (See Figure No. 1 on this page.)

This shows the unit cost of producing a certain punching with a combination class "A" die as compared with the unit cost of producing the same punching with a series of simple dies which are carried in stock. The vertical distance represents dollars and the horizontal distance represents quantities. The solid line indicates the use of stock dies and the dotted line indicates the use of the class "A" die. You will note that the unit cost in the latter case starts at $150.00, covering the cost of the die, while the unit cost using stock dies starts at a very low figure. This demonstrates that in quantities up to 20,800 this particular punching can be produced at a lower unit cost by using stock dies. The same principle of comparison can be applied to other tools, such as jigs, fixtures, screw machine set-ups, and the like.

Besides the unit costs, tooling has an important economic bearing on many other factors which determine the success of a product. First is quality of the product being produced, which should include 100% safety to the user. A lot of this quality and safety can be tooled into the product. For example an electric washer or other household appli-

(Continued on Page 72)

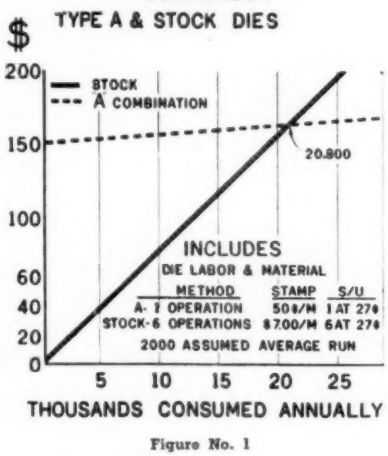


Figure No. 1

Tooling Large Products—Large and Small Quantities

(*Economics of Tooling*)

By

W. T. STEGEMERTEN,

SUPERINTENDENT

EQUIPMENT AND METHODS DEPARTMENT
WESTINGHOUSE ELECTRIC AND MANUFACTURING COMPANY, SOUTH PHILADELPHIA WORKS

THE terminology of large products covers a wide range of classifications and types. They may be standard (repetitive or special with minor modifications) or special with radical changes on each unit manufactured. They may be diversified with changing conditions and call for engineering design from the ground up. While the basic principles of tooling are the same, the latter is the condition and problems encountered with the product manufactured at our South Philadelphia plant, Lester, Pennsylvania — Steam Turbines (Industrial and Central Station), Marine Propulsion, Pumps and Heat Transfer Products.

The manufacture of these products requires a plant layout consisting of: Rolling Mill, Forge Shop, Acid and Shot Blast Process Cleaning, Heat Treating, Tool Manufacturing, Screw Machine, Fabricating and Welding, Sheet Metal, Small and Large Detail Machining (5 divisions), Gear Cutting, Assembly—(2 divisions), Testing—(2 divisions).

Our plant consists of: 87 acres in active use. 1,329,267 square feet of floor space under cover. 100 overhead cranes with variation of 1 ton to 100 tons. 1,600 machine tools, with a range of 10″ to 160″ engine lathes, 3′ to 32′ vertical boring mills, et cetera. 1,200 hourly rated production employees, normal. Our load and back log variation is about 7 to 1. Our shortest delivery on completed apparatus is one week, and the maximum 33 months.

While there are many similar parts in our product, to my knowledge of industry, it can be called special "Diversified Product" and it is this picture you should keep in mind as we proceed.

It is difficult to predetermine the life of the design and expected quantity on a tailor-made product; therefore, we must consider, mainly, universal equipment and its life.

Again the customer's demands for delivery reduce the time allowed for planning, thus the Tool Engineer must be in constant touch with the design from its inception, reducing the period of time between product design and production.

Tooling is considered and divided into two classes: First, major tools or machines, Second, small tools and fixtures, including cutting tools.

Both are influenced by the plant layout which presents a third problem. Each is a subject for discussion and on which a whole session could be devoted. With the limited time, I shall stress only the major elements:

There are certain general fundamental phases and questions to be considered at all times, that we think of as affecting manufacturing cost but unquestionably also affecting tooling, large or small quantities. I shall state these before proceeding with the specific problem of tooling.

a. Is the product designed around existing equipment?

b. Are material specifications related to manufacturing processes?

c. Have patterns and castings and the foundry been related to manufacturing requirements?

It is very important that the pattern shop and foundry be made acquainted with the basic points and layout for machining and tooling, as they too may work from the same points; thus simplifying the problems of tooling. Too little stock may be more serious than excess stock; affecting cutting tools and fixtures, to say nothing of quality.

d. What is the relative importance of succeeding operations and the final assembly?

e. What are the limitations of machine capacity; can we justify fixtures to meet abnormal demands on specific types?

f. How far shall the machine shop go?

g. How much or how little should be left for the assembly floor?

h. Design component parts to reduce size; investment of tools and machines.

Assuming that the product design has been torn apart and prepared for manufacturing, it now becomes a problem of weaving tools around it. These tools must be ready for the job when it arrives.

Why do we tool?

Tooling is necessitated by manufacturing demands due to: Design, Increased production, Cost reduction, Tolerances, Replacement, Quality, Interchangeability, Improvement in the art, Metallurgical advancement.

The analysis is the same in all cases.

Regardless of the demand, all factors should be considered. There is latent economy in a replacement tool as well as in that of tooling for extreme accuracy or low cost. When considering a replacement, we do not arbitrarily buy a duplicate, but take into account all factors that may justify a more or less expensive tooling, provided, of course, that we maintain versatility.

Consider a simple problem affecting small and major tooling: The design engineer specifies a part made from bar stock and the first operation is "cut to length." This may be performed by: Hand hack saw, Power hack saw, Abrasive saw, Hy-speed metal saw, Turret lathe, Milling machine.

Quantity alone does not decide the economy. It is necessary to take into account: finish, accuracy, material loss, the succeeding operations to complete contour: these to be balanced against the basic machine hour cost, cutting tools and upkeep. The small tool problem varies with the type of equipment selected and quantity.

Small Tooling—Small Quantity

With a new or changed design an analysis is made of each drawing, checking against records of existing tools and deciding on new tools. This is based on past performance and existing manufacturing methods and processes. If design changes are such as to demand new tools, a schedule is prepared, predicated on past performance. Such

Figure A. Parts to be machined vary in size and weight, the smallest being one ounce and the largest 130,000 pounds. In the illustration above the man is shown holding the smallest part between his thumb and index finger—conveying its relative size to the largest part.

tools are necessary to fit in with a predetermined setup and manufacturing process, and must be provided to meet accuracy, quality, interchangeability, balance machine load, and in some cases justified to off-set high manufacturing cost.

Tooling for small quantity must be given the same close analysis as large quantity to affect economy, particularly with respect to tooling for the proper machine. Consideration must be given to: Engine lathe versus turret, Horizontal versus vertical milling machine or drill press, Planer versus grinding or milling.

Large products have certain standards with respect to general tooling, cutting tools, form tools, et cetera, which must be duplicated as dimensions change.

The Tool Engineer must be on the lookout for accumulated quantity, justifying special face plate clamps, chuck jaws or tool holders.

Fixtures are considered, for the greater part, to meet the demands of the design as to accuracy and contour or accessibility with respect to universal shop equipment, but keeping in mind accumulated activity of similar designs which may justify interchangeable tools with conjunction parts. As an example: we recently made a check on a certain fixture which was required for a given operation on blades which changed in their base dimensions and contours. An analysis revealed that if we should spend more money on an interchangeable basic fixture to cover a given range, conjunction parts could be made; thus reducing our tool cost over a year's period, and eliminating storage space which I assure you was no small concern.

With the proper analysis some inexpensive tools may offset assembly cost and aid in maintaining a balanced load. Here again it is necessary to consider the fundamental factors of machine hour cost.

The foregoing sounds like the ideal, but how do we put it into practice:

Figure 1—Is the one side of a combination record, listing the manufacturing operations necessary to produce a part.

Figure 2—Is the opposite side of a record shown in Figure 1, listing the tools and fixtures for the operation layout.

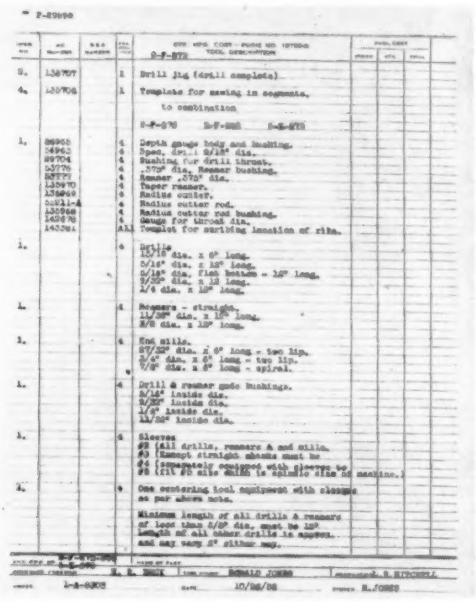
Cross reference files, of tools by part terminology, are maintained for existing tools on similar parts. These serve as an inventory and activity record; calling attention to duplication of similar tools with varying sizes and demanding analysis for universal tooling or standardization of design.

Figure 3—Shows this record card and happens to be a case which developed the demand for a universal fixture as illustrated in Figure 4—eliminating the necessity of tooling each time, reducing cost of tools and expediting planning.

Figure 5—Is the form used to record new tools required, with design and tool estimate, and from which action is initiated.

Recently, in an attempt to justify tooling a small quantity part, the investigation developed into a major change of methods and tooling on similar parts with large quantities, effecting a reduction of 65%. So it does not pay to overlook the small items when we do not know all of the tangible problems and answers.

Left — Figure No. 1. Combination record, showing manufacturing operations necessary to produce a part.



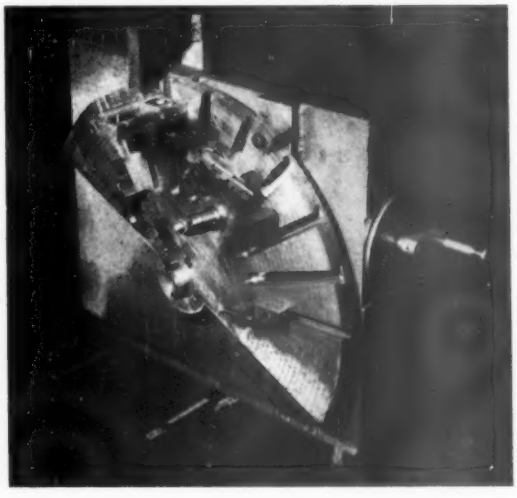
Right—Figure No. 2. Opposite side of same record, listing the tools and fixtures for the operation layout.

Nozzle Block and Rev. Chamber Drill Jig
Basic Fixture—Jig No. 141538—SKA-452805

Jig	SKA	Dia.	Use with	Spacing	
144046	453165	25 11/16	J-141538	See SK.	Parts
144025	453162	25 9/16	"	"	"
144045	453164	25 11/16	"	"	"
144047	453166	25 9/16	"	"	"
144039	453171	25 9/16	"	"	"
144027	453163	25 9/16	"	"	"
144018	453167	25 9/16	"	"	"
144020	453167	25 9/16	"	"	"

P-29901

Above—Figure 3. Record Card of existing tools for similar parts—serves as an inventory and activity record; also aids to prevent duplication of tools.

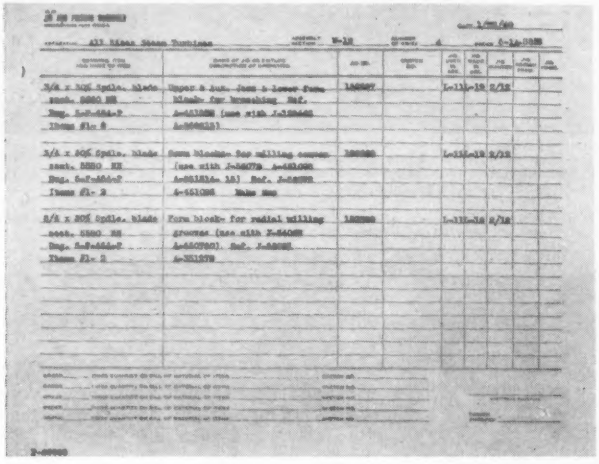


Right—Figure No. 4. Records and system described by the author, result in universal tools as for example the fixture shown here.

Small Tooling—Large Quantity

Large quantity production is so uncertain on standard parts and such a shock on customers' orders, that it becomes necessary to treat both alike. The same basic records, previously described, are used.

Operation layout and cost is made on the basis of small quantity production or past performances.



Left — Figure No. 5. Shows record form used to show new tools required, with design and tool estimate, and from which action is initiated.

Right—Figure No. 7. Showing an operation performed on special machine with low cost tooling for small quantities.

Detail analysis is made of each operation to determine if improvement can be made to effect economy of any one of the factors previously mentioned.

Consideration must be given to special fixtures or standard universal tools with interchangeability.

Tools are recommended and cost stated.

Comparison is then made with tools and without tools, and tooling decided based on the factors justifying same.

Unit cost difference is shown and related to the activity and expected life of design. Justification of tooling is then submitted to engineering, sales, and shop management for approval.

Figure No. 6. Example of small tooling for manufacturing demand to reduce load on the machine, which also reduces the cost.

Quantity may express itself in standard parts authorized for stores stock or on a specific order. In the latter case, duplicate tooling may be necessary to parallel operations effecting a balanced loading to meet a short delivery.

In the case of standard stock parts, tooling can be based on the total number of units to be produced during the life of design. In the case of quantity on a specific customer's order, tooling must be justified by the number of units on the order.

The economies of tooling a specific, special order may be tangible to our standard product, which ordinarily would be a small quantity variable design; therefore, we cannot overlook versatility.

Quantity may overload specific types of machines, and is therefore divided into two classes:

First—quantity of the same design or duplication, which obviously demands analysis.

Second—quantity creeping up or accumulating due to similar design. This presents a more difficult problem for the Tool Engineer, and requires constant vigilance, a high degree of foresight, and vision. The tool must be universal to varying sizes, shapes, materials, and tolerances.

Small tools and fixtures, as well as machine tools, may have to be duplicated to balance the load or meet customer's commitment. Such conditions cannot be anticipated, since there is no way to predict the customer's demands on a tailor-made product.

A typical case is one of drilling horizontal partings of cylinders for which we do not normally provide tools; but in the case of a quantity order, drill jigs were provided to produce uniform accuracy, eliminating the human element for duplication, expediting delivery, and assuring balanced machine load. The cost of tool is not offset by the difference in tangent unit cost.

Small tools and fixtures are necessary to meet production layout of machines and floor space, avoiding tool room methods.

Figure 6—Is an example of small tooling for manufacturing demand to reduce load on the machine, which also reduces cost.

Example of analysis on a unit for which an activity of 200 per year was forecast: The study completed and results of tooling summarized indicated that cost could be reduced and tool charges absorbed on the first 66 units. The figures were:

Cost Without Tools	Cost With Tools	Reduction Per Unit Cost	Cost of Tools
$268	$147	$121	$8014

$$\frac{\$8014}{\$\ 121} = 66 \text{ plus (no. of units required.)}$$

Obviously the safety factor is great enough to offset errors in forecast; the tools were made.

Major Tooling—Large and Small Quantities

Machines for large quantity production are analyzed in the same manner as small tools. The two are synonymous. To determine the small tool design we must take into account the machine it is to be used on. We must also consider the relation of small tool cost with the machine tool, and in many cases justify tooling up on a drill press; operations normally performed on a horizontal boring mill.

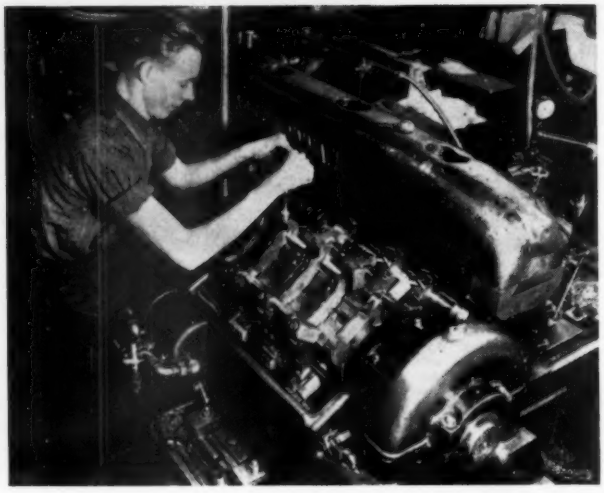
This brings up the question of whether we should have a special machine tool with little or no small tooling, or a standard, universal machine with special small tooling. The latter is most desirable for our product and universally practiced, exceptions only where unit cost and activity justify. We have both conditions.

With a standard machine tool and special fixtures we are not burdened with idle and short-lived equipment, and need only to discard the fixtures. To illustrate:

Figure 7—Shows an operation performed on a special machine with low cost tooling for small quantities.

Figure 8—Shows the same operation on a converted standard machine with high cost tooling, as justified by large quantity. (Illustrated on following page.)

Diversified parts with similar operation (hand scraping of partings), with sufficient hours to justify changing from hand operation to machine, created the demand for a special machine for lapping.



Left—Figure 8. Same operation as performed in Figure 7, but being done on a converted standard machine with high cost tooling, as justified by large quantity.

Above—Figure 9. Customer's demands on a specific order created demand for this additional large size vertical boring mill.

Figure 9—Another striking example was that of a demand for additional large size vertical boring mill, created by a customer's demands on a specific order. This machine is standard and universal, but expensive; we did not have space and could not carry the machine at normal load. The Tool Engineer went to work and designed an inexpensive horizontal mill, swinging the tool instead of the job. The investment was wiped off with the unit cost difference on the job. Small quantity would not have presented this problem. The inexpensive horizontal mill is shown in Figure 10. Unfortunately, we did not have a job for the machine when photograph was taken.

I wish to emphasize that a diversified product requires constant vigilance on the part of Tool Engineer, foreman, and production service to build up quantity by collecting similar parts of dissimilar designs, and break down quantities to balance loading, but still accomplish the greater economics of tooling.

Figure 11—Illustrates a standard horizontal mill with an expensive universal fixture for drilling of steam passage ports. This may be further developed for a radial drill.

Figure 10. Inexpensive horizontal boring mill.

A few years ago we were not convinced that our quantity production would justify broaching. However, we felt that a study should be made of the influencing factors and from them draw the conclusions.

The results were that a modified standard machine with basic fixtures and conjunction parts with universal broach holders would satisfy our requirements. Today we have four machines, with the fifth on order.

Figure 12—Shows one of these machines set up.

Operation and tool analysis demand consideration, whether small or large quantity. The analysis should consider: The effect on: Machine loading by types, Floor space, Delivery, Interchangeability, Manufacturing cycle, Stores inventory, Relation to assembly, Quality, et cetera.

New Design—Small or Large Quantity

A new or changed design affecting the line may involve an increased load on a particular machine and a decreased load on another. However, after the operation layout is made, the increased load is the first concern and it is obvious that a request may be made for an additional machine. On small quantity production this condition creeps up quite frequently, switching work between horizontal, vertical boring mills and radial drills.

Let us consider an operation formerly or normally performed on a radial drill: The design now demands a horizontal boring mill and overloads existing equipment, resulting in a request for another machine. The first thought is that this may unbalance our cost center, thus an analysis should be made as to: What is life of design and expected activity? Can design be changed at no cost increase? Can design be changed at a cost increase? Cost of new ma-

(Continued on Page 48)

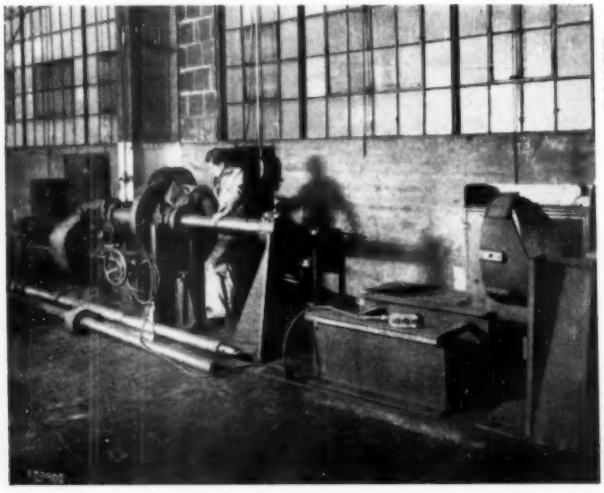


Figure 11. Standard horizontal boring mill with an expensive universal fixture for drilling.

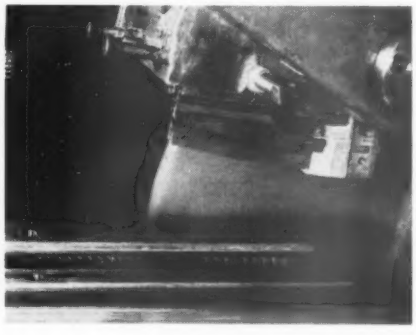


Figure 12. (Right) Showing a modified standard machine with basic fixtures and conjunction parts with universal broach holders.

Tooling Large Products—Large and Small Quantities

(Discussion)—Economics of Tooling

By

J. M. CRAWFORD

ASSISTANT SUPERINTENDENT
GENERATOR-MOTOR DEPARTMENT
SCHENECTADY WORKS
GENERAL ELECTRIC COMPANY

IT is a pleasure for me to have the privilege of discussing the first paper presented at this conference on the subject "Tooling Large Products—Large and Small Quantities." You must keep in mind that we are discussing the tooling for manufacture of very diversified lines of products or apparatus. The department referred to in this discussion paper is the Generator-Motor Department of the General Electric Company, Schenectady Works, and manufactures apparatus covering a wide range of types and sizes from 4 kw to 100,000 kva in speed ranges from 40 rpm to 3600 rpm and voltages from 6 to 22,000 volts. My discussion will deal with some different products and some overlapping of products from the paper, but the problems of tooling are practically the same.

Mr. Stegemerten has covered this subject in a very commendable and thorough way and I agree in general to his analysis of it. I will, however, endeavor to summarize his paper and discuss our experience with this similar problem in manufacturing the diversified apparatus referred to above.

Admitting that a subject such as this and in the short space of time allowed must be handled from a more or less general viewpoint, I would like to stress some of the salient points of Mr. Stegemerten's paper and with particular emphasis on a practical specific way of handling the problem.

For the purpose of discussion, let us divide—as he has—the tools involved into two main classes:

1. Major machine tools and equipment.

2. Small tools, such as jigs, fixtures, portable hand tools, etc.

Major Tools

Major machine tools and equipment are those tools necessary to process a given line of apparatus. When the lines of apparatus such as we are discussing here, regardless of quantity, are of such a diversified nature, these tools must be of standard design for general purpose use; for example—many of our tools are required to machine very large parts. It is interesting to note that the advancements in the sizes of machine tools has enabled us to extend the size of our apparatus design and manufacture them with greater accuracy, thereby eliminating extensive handwork, fitting, etc., when assembling.

A few examples of these tools are the large industrial lathe which will swing a piece 120 inches in diameter, and 52 feet between centers, boring mills capable of boring and facing parts in conjunction with portable tools, etc., up to 60 feet in diameter. Also, it is interesting to note that during the last ten years the trend in design of this type of apparatus is from casting to fabrication due to the advancement in the art of welding. Studies of tool equipment on castings versus fabricated parts reveal that, for parts produced in such quantities as we manufacture, lower unit cost in general is obtained with fabrication. This results in reducing machining time or less metal to remove, elimination of pattern and pattern storage, hazard of casting losses, and overall production time. The major individual parts are designed and planned to have the major machining operations done on machine tools with carefully planned setups because in many cases the setup time is equal to or more than the actual machine time. During the processing of large units of apparatus much use can and has to be made of portable and especially designed tools because it is a much simpler job to bring the tool to the work rather than take the work to the tool. These tools as well as all others represent production centers.

Here we should consider a point brought out in the paper of "How far should the machine shop go and how much should be left to the assembly." This is a very good point and bears much emphasis. There is an overlapping of these two phases of manufacture or machine operations which should be considered a definite part of the assembly. Example of this is the assembly of ventilation housing on a single large vertical water wheel generator or the preliminary line-up of the parts on the base of a single large motor-generator set before the drilling of the base. Two methods can be used:—

1. Make jigs or templates to drill the various parts.

2. Scribe base from pre-drilled parts after alignment.

Analysis show that scribing the base from pre-drilled parts to be better and more economical because of the expensive jigs necessary and the possible errors caused by tolerance allowance on the drawings making handwork necessary during assembly. Experience, judgment, and cost must all be considered in deciding the method used.

In order to get the most economical usage from these tools, thorough studies must be made of the planning of the various lines of apparatus and the factory layout made from these studies to enable us to process the various parts with a minimum amount of material handling. Studies must also be continuously made of capacities on production centers at various factory loads. Through these studies of various lines of apparatus, we determine the man-hours required on each production center for a given factory load and, from the man-hours required we can readily determine the number of tools necessary to meet production requirements at a stated factory capacity.

Small Tools

How do small tools enter the picture? It is conceivable that we could manufacture our lines of apparatus with very little consideration given to small tools, jigs, fixtures, portable hand tools, etc. Then, why do we build them? The answer to this has been ably given by Mr. Stegemerten. These tools must be considered for several reasons: 1. Improvement in cost. 2. Quantity production. 3. Improve quality. 4. Interchangeability of parts.

If small tools result in economical production, then when do we give them consideration?

Requisitions for our apparatus vary from quantities of one for the large equipment to quantities of ten for the smaller sizes. Although this large apparatus is custom built and limited in quantity each of these units has some component parts that occur in sufficient quantities to permit consideration for tooling, such as punchings often made with expensive combination dies, etc. Contrasted to the quantity parts in the large apparatus we have quantities of complete units in some lines of our smaller apparatus. Orders for these complete units or machines occur in quantities of from one to ten and quantities beyond this point are very unusual.

Tools can be economically justified for two reasons:—

1. When parts occur in sufficient quantities on a specific requisition that the cost of the tools can be liquidated on a unit cost basis.

2. When parts that are common to a series of lines occur in sufficient quantities so that the cost of the tool can be liquidated on a unit cost basis over a pre-determined period of time.

So far, we have discussed tooling as applied to quantity production where the cost of the tool can be justified on a unit cost basis. However, it might be well to mention here that tooling must be given consideration on specific jobs for reasons other than cost advantage. This is especially true where supply parts are to be furnished in small quantities. In such cases, shipment is of utmost importance. We are able to materially reduce our process time by the use of universal tools adaptable and adjustable to a limited range of sizes. In such cases service to the customer outweighs increased labor costs resulting from the use of such tools.

Again, quality of product and customer's requirements must be weighed on some products. Where tolerances

(Continued on Page 50)

Tooling Small Products - Large and Small Quantities

(ECONOMICS of TOOLING)

By
F. E. DARLING
WAGE STANDARDS DEPARTMENT
CAMERA WORKS, EASTMAN KODAK COMPANY, ROCHESTER, N. Y.

IN preparing this paper on the announced subject, I have borne in mind the underlying purpose of our meeting here. Accordingly, there will be little said about tooling techniques, as such, and our whole attention will be given to the problem of developing a formula which will be a guide to correct tool expenditures—given a known product to make and the best forecast we can get of how many we shall be called upon to produce.

Let it be said now before it becomes self evident that I do not come here as a Tool Engineer, nor am I prepared to give you wrapped up in a package an answer to your problem, an answer which has been tried and tested in our Company. Therefore, please regard my remarks as a suggested solution, subject to your criticism.

To make sure that we are thinking of the same problem permit me to restate it. We know first that we can make any item of our line by hand if we wish, and the term "by hand" is used in its broader sense. It includes the use of lathes, drill presses, brakes, and any hand tools such as files, saws, and so forth, which in no way may be defined as tools made for a specific product. We know also we can tool to make the same product in varying degrees ranging from the most elementary types of dies, jigs and fixtures up to equipment which will produce the product automatically. As we increase the degree of tooling we are making an investment in equipment which presupposes certain savings will be made by virtue of those same tools.

We all know, that the more we spend on tools the more we are likely to save on production cost. But, as manufacturers we are interested in balancing increased tool cost against decreased production cost so that the sum of both items is as low as we can possibly make it. The proper amount of money to spend on tools is, therefore, that amount which when combined with the cost of producing on those tools gives us the lowest possible combination.

This problem of two conflicting costs is neither new nor is it peculiar to the work of the Tool Engineer. The architect who designs a skyscraper gets a decreasing cost per cubic foot for land and building the higher he builds it. But opposed to this, there are less and less cubic feet available for occupancy because he has steadily increased the amount of space needed to provide adequate elevator service. He has derived a formula which dictates the economical height of a building based on land and building costs and rental value. The power engineer, as well, has had to learn how far he may go in increasing a turbine's size and cost in his effort to get more and more useful energy out of a pound of steam.

Cost Relationship

I shall try to make clear the cost relationship which exists on the Tool Engineer's problem. Although the analytical technique described is applicable to all kinds of tooling work, I think it will help everyone if they will, for the moment, consider this as a problem in tooling for parts which are normally made by punches and dies in a punch press.

Imagine, if you will, that we have a part to be made, and that we have first designed the simplest set of tools we know of and that by gradual steps we have designed other sets of tools for making the same part but that in each case we go one step nearer the extreme which is full automatic production involving no hand labor at all. This progress on the scale of tooling will be represented by the letters E D C B and A, as shown in Figure 1, and they may be defined as follows:

Hand

Parts are cut on square shears or sawn out, all holes are laid out and drilled without jigs. Forming is done by hand; burring by file.

Class E Tooling

Parts are blanked with simple wafer dies using rubber as a punch. Holes are drilled from layouts without benefit of jig or templet. Forming is done by hand, brake or vise; or at the most, simple blocks, squeezed in a vise or arbor press.

Class D Tooling

Blanking is performed in wafer dies using unmounted punches. This is the type of die where material is laid over the opening, a punch is placed by hand, pressure is applied. Blank scrap, punch and die are separated and the next part is done. In this degree of tooling, perforating, embossing and forming are all done in the same manner. If holes cannot be made before forming, resort may be had to simple templets for drilling.

Class C Tooling

We now step into limited production but by no means small from our viewpoint. Dies are now mounted in die sets. Perforating is likely done in follow dies along with the blanking. Forming and embossing, are done in separate mounted dies and also any perforating which must be referenced accurately to some point by forming.

Class B Tooling

Compound dies are now the rule. Blank and perfórate are accomplished at one stroke, but forming is usually done separately.

Class A Tooling

Progressive dies are made in an attempt to complete the part in one operation. Semi-automatic roll feed is employed if possible.

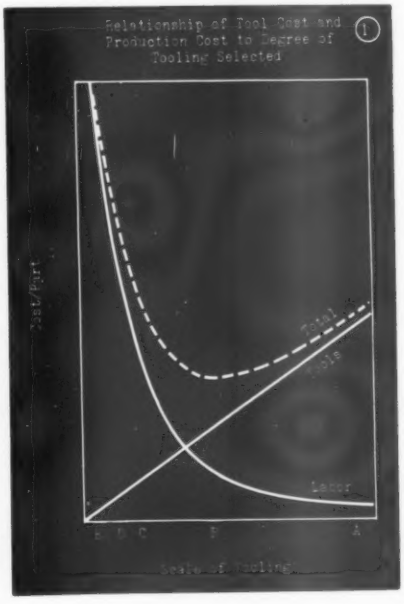
Automatic

Beyond this point lies the stage of automatic production which includes not only the creation of the part but its assembly with mating pieces.

Having designed these tools, production costs can be estimated for each step and, corresponding to these steps, we find that the cost for productive labor (Chart I) goes from a very high point when we make the part by hand to an exceedingly low one when it is made on a fully automatic machine. The shape of this curve which pictures decreasing labor costs as we go out on the scale of tooling is dependent on many things. First, the processes with which we are dealing are important; for, the curve would necesarily be different for lathe and screw machine tools and even more different for drilling jigs or forms used for spraying lacquer.

Secondly, the hourly rates paid to direct labor has its influence and; thirdly, the shape of the curve is very intimately tied up with the ingenuity exercised by the Tool Engineer. Later in the talk, I shall take up the question of obtaining this curve for your company, and your kind of work, but, for the moment it will be sufficient for you to recognize that it is a good general pattern for cost reduction on a typical part. As we pass through the various stages of tooling, all the way from hand manufacture to automatic production we are naturally

Chart No. 1



increasing the cost of tooling and this increase is shown by the curve marked "Tools." It is important that you remember that the tool cost as shown is reduced to a "per piece" basis. Thus, if type "B" tools to produce the part cost $200, and we are going to make 2,000 pieces, then the tool cost "per part" is 10c.

Now, we have shown how production cost decreases as tool cost increases. If we can select the combination of the two which will yield a total cost which is minimum we have obtained our objective. The "Total" line shows total cost and this is merely the sum of labor cost plus tool cost at any given point. It is clearly evident that we pass through two stages. In the beginning we have a rapid decrease followed by a less rapid increase leaving in the middle a very well defined minimum point. It is this point which gives a combination of tool and labor cost which is minimum, and the point lies directly over the degree of tooling needed.

It follows from the example shown that if "B" class tools are designed the total cost to make our parts will be as low as we can attain.

To sum up what we have found, in a general way, we can say as a principle, that whenever we are confronted with two costs, one of which is rising while the other falls, the combination of the two has a well defined minimum at a point corresponding to a definite degree of tooling.

So far, we have been talking about the so called typical part which represents your work and we have discussed the simple case of a fixed and known quantity to be made. Suppose, then, we look at the same problem but inject into it the possibility of making 10 parts, 10,000 parts or 1,000,000.

Our second chart, Figure 2, shows how tool costs on a "per piece" basis vary depending upon whether we propose to make a small or large quantity. If the quantity we are to make is exceedingly large, the cost "per part" for making the "B" type tool is very low, however, if the same "B" tool is to produce but a few parts, the tool cost for each of those parts is correspondingly high. You will notice, that no actual figures are used and this is for two reasons: What we consider large production may be laughably small in your estimation, or what we consider small may appear to you to be very large. In either case, the relationship and the principles are the same, and there is no need to discuss actual quantities. The second reason for omitting quantities here is that in practice you will find it impossible to show the case of 50 parts on the same chart with a million because a scale which is satisfactory for one is not for the other.

You will recall if you think back to our first chart, that the line corresponding to tool cost influenced the decreasing labor cost curve so as to produce a minimum. In the same way, each of the three tool cost curves shown here produce their own separate minimum points, with the result that you see on chart three (3).

Thus, for the same typical part, if our production is small, the "C" type tooling is indicated; for medium production, the "B" type is best; and for large production, we find it most profitable to employ the "A" type tool. Even larger production than that shown would definitely recommend for our consideration the possibility of tooling for the job to be done automatically. There is no reason why you cannot derive a similar set of curves for your work employing steps in the quantity made which fit the range of your experience. In this way, the proper type of tooling is indicated for fifty parts or five million.

The next step is to convert the knowledge that we have gained from this analysis into the actual money which may be spent in tooling for a given product, knowing, of course, the quantity that we are likely to make during the life of that product. From our chart, Figure 3, we find that the typical part when made in medium quantities requires the "B" class of tooling. If we have found in our study that "B" type tools, to produce the typical part, cost on the average $200 and if the model we propose to make is composed of twenty press parts, the best investment we can make in tools would be approximately $200 x 20, or $4,000.

On the other hand, if the quantity to be made were small and "C" type tools, which cost on the average $100, were indicated, then, the proper tooling investment would be 20 parts x $100, or $2,000.

We have, in all cases, omitted actual money values from these charts, because any derived at our plant would be sadly misapplied if used in any other plant.

If this approach to the problem interests you, it will be necessary to make a survey of your own. Firstly, selecting a group of parts which you consider a representative sample of the work you do. Lay out the operations on each one as if you were going to make the parts by hand. Decide on four or five stages of tooling, each step calling for a higher degree of mechanization so far as the production operations are concerned. Estimate the cost of tools in each case, and the corresponding cost of producing the part. After modifying your tool costs by dividing them by the quantities you might produce (that is, first 500 then 1,000, 2,000, etc.) you can then construct the total cost curves in the manner shown in chart "I." The results, if your samples have been carefully chosen, will indicate the amount of money you should spend in tooling any given product for a given quantity of production.

Some of you will feel that the experience on 25 parts is not sufficiently broad a foundation on which to base so important a decision. You will be able to find specific examples where the average results indicated by such a study would not hold. While this is entirely possible, the extent to which this technique is erroneous insofar as the individual part is concerned does not alter the fact that the figures are right when we take into account the averages with which we must deal when considering all the tools for a given model and all the models which we must prepare to make in a given year. The approach to the problem that we have outlined in this paper, is suggested rather as a managerial control than as a means to obtain the answer as to tool cost for a specific part.

On a chance that someone may like this proposed analysis sufficiently well to go home and try it, I should like to point out one more phase of it. There

(Continued on Page 56)

Chart No. 2

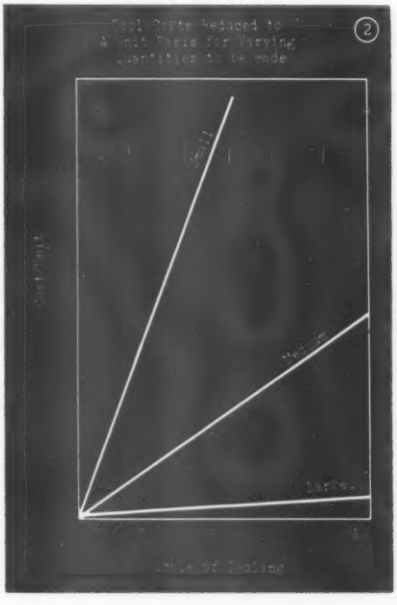
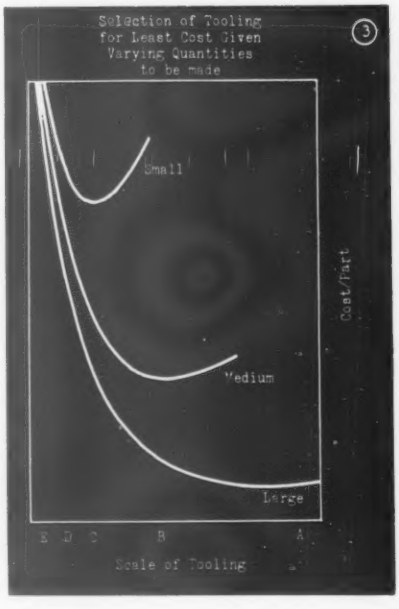


Chart No. 3



Tooling Small Products—Large and Small Quantities

(*Discussion*)—*Economics of Tooling*

By

W. J. PEETS

ASSISTANT SUPERINTENDENT
ELIZABETHPORT WORKS, THE SINGER MANUFACTURING COMPANY, ELIZABETHPORT, N.J.

IN discussing Mr. Darling's paper, I must agree that under the conditions outlined his reasoning is faultless.

His example is a mechanical unit comprised of a number of sheet metal parts which may be made by six different methods or with six different types of press tools ranging from "by hand" to full automatic tool plants.

The total number of parts to be made is known as well as the cost of operation by the various methods.

If I understand Mr. Darling further, a certain number of these parts are selected, the proper curves are drawn, for small, medium and large lots, and from these curves the tool cost of any product can be determined by multiplying the number of parts in the unit by the proper figure obtained from the curves.

I can imagine that if the product of a company consisted of a limited range of various sizes of similar units all made of the same materials and by the same general methods, a manager might come to a conclusion as to the cost of a set of tools for an additional size but similar model or at least the figures obtained might be used as a guide.

I can imagine further that if the manager took his curves seriously, he might make it real uncomfortable for the engineering department that had the responsibility of laying out and building the tool plant.

I think it would be nice to be a manager but I must discuss this paper from the point of view of the Tool Engineer and as such, I believe that the problem as outlined has been over-simplified.

I believe that in most cases the tooling problem is much more complicated than that cited by Mr. Darling.

Function of Tool Engineering

The function of the Tool Engineering department in a modern plant is to tie together the product development department and the manufacturing departments. The Tool Engineer's interest in a new product should date from the first moment that this product is discussed and should never cease.

Suppose we are discussing a suggested new product. This may be an improvement of an existing model or an entirely new model, differing in function and appearance.

This new product must above all things compete with similar products on the open market.

To offer the buyer better value, the new product must be better or more desirable than that it displaces or it must be produced and marketed at a lower cost or both.

A tool plant must be built to accomplish this or the model abandoned.

Desirability and cost, all else being equal, are the things that will most likely determine the sales volume of this new product.

This usually means that the new model will make use of new materials, and new methods of manufacture to achieve the above named results.

Die castings or bakelite materials may compete with sheet metal—drop forgings may compete with cast iron and these materials must be selected for function, appearance and cost.

From the very first, therefore, the Tool Engineer will cooperate with the product designer and the manufacturing departments.

As the new model takes shape, so also will the tool plant for each part is envisioned in the mind of the Tool Engineer. He will consider each operation and every effort will be made to eliminate high labor and material costs as well as high tool costs.

When the final model is ready for demonstration to the management, all questions of manufacture should have been settled, and after-designing in order to economically manufacture the model should be unnecessary.

All this work is done to achieve a more desirable product, the selling price of which is already pretty well established by competition and the sales volume and profits of which will depend on how well the designer and Tool Engineer have done their work.

Desirable Product vs. Lower Tool Costs

My point is that we do not often start to lay out a tool plant knowing the sales volume or number of pieces to be made and the shop methods to be used. Rather, the problem is to bring out a more desirable product for less cost and thus increase the sales volume. This often results in an entirely new relation between manufacturing costs and tool costs.

This new model when perfected therefore, should be presented to the management for adoption or rejection, as the joint effort of the designer, Tool Engineer and manufacturing departments.

Their report should be simple and short.

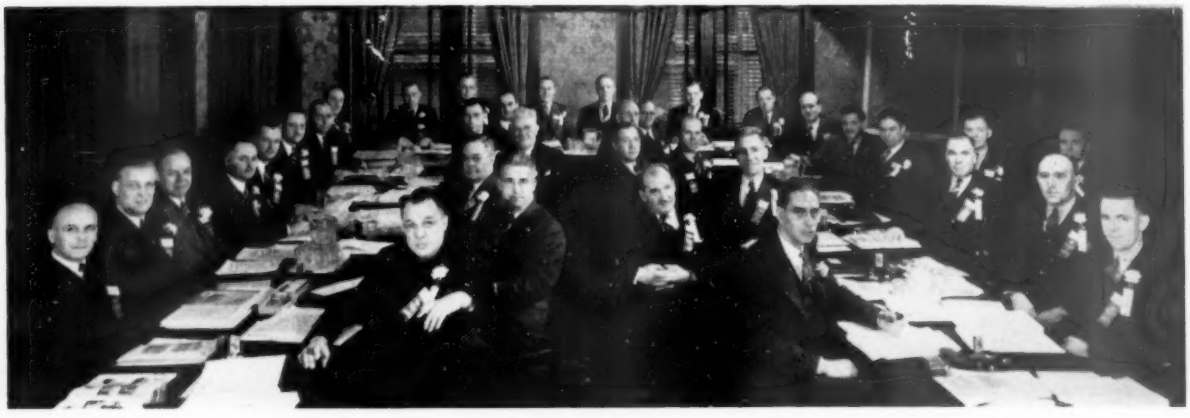
1. Here is your new model with test reports on same.
2. The manufacturing cost of this model will be so and so much.
3. The tool plant to produce this new model for the above cost will be so and so much.
4. The new model can be in production by so and so date.

With this data in hand, the management with the sales department will have to decide—

1. Is this model desirable and will it meet competition?
2. Is the cost estimate sufficiently low to allow a profit?
3. Will the sales volume warrant the capital expenditure for tools and equipment?
4. Is the delivery date for the new models satisfactory?

(Continued on Page 52)

A solid day—from 10:00 a.m. until 8:30 p.m.—was spent by the A.S.T.E. Board of Directors in session at the New Yorker Hotel, March 7th. In this Board is vested the administrative authority of the Society. Each member is a past National Officer or a chairman of a chapter.



PRECISION SMALL GEARS

Symposium on the subject as given at A. S. T. E. Technical Session, March 7th 1940 in New York City

Industrial Requirements of Small Gears

By

THOMAS TURNER

MANAGER, METER DIVISION
WESTINGHOUSE ELECTRIC AND MANUFACTURING CO., NEWARK, N. J.

DUE to the European War certain curtailment and even stoppage has resulted in exports from Europe. The increase of business amongst manufacturers brought with it the need for equipment, especially machine tools and that this is so is demonstrated by the present delivery dates being quoted by machine tool manufacturers. However, all the machine tools used in this country are not manufactured here, and as some of them are manufactured by belligerent countries, it was felt by this organization that perhaps one of the types of work affected was the manufacture of small gears. This then is the reason for this meeting and I have been requested to try and present the manufacturer's problems on this subject.

In order to limit the scope of this discussion the term "small gears" shall apply to gears having approximately 30 D.P. or smaller, i.e., similar to the ones on exhibition and to those used in the clock and watch industry.

We have tried to get a cross sectional picture of industry of this type to determine their needs, and to see if they are being embarrassed by the present international situation, and to further ascertain what their wishes were, in order to present an overall picture.

If there is a need for equipment of this type, what are the conditions to be met:

1. The machine must be of sufficient accuracy to meet the small tolerances of small gears.

2. The direct labor cost of operating the machines must be at least equivalent to those already in operation.

3. The original tool or cutter cost, plus the tool life must be competitive.

Let us look at these three points a moment or two. If there is a definite shortage of this type of equipment, the tendency would be to take the equipment, provided it would fulfill condition No. 1, namely, that it had the required accuracy, without too much attention being paid to the total operating costs. That would be a bad mistake, as I believe we have all seen machines standing idle in our plants because of operating costs. Furthermore, if the machine tool manufacturers do design and market machines to compete with a present closed source of supply, the source now closed will some day be again open, and, if the sales of the American made machines has not been sufficiently large to write off the development costs, industry will have to foot that bill, one way or another. So you see, operating costs are important, even in times like this.

In order to get "close to home" on this subject, I will describe the Westinghouse Electric & Manufacturing Company's small gear manufacture as performed in the Meter Division, located at Newark, N. J.

We cut over 2,000,000 teeth daily in gears ranging from 8 to 135 teeth per gear.

The pitch range is from 30 to 120 D.P. and in the main volume is on the 120 D.P.

The types of gears are Spur, Worm and Crown Gears.

The material used is mainly clock brass, but bronze and low carbon steel is also used.

All of our gears have cut teeth.

The machines used for gear cutting are of the form milling type. A highly accurate milling cutter for the profile of the tooth space is fed automatically through the work. At the end of each cut or stroke the cutter spindle is raised so as to avoid dulling the cutter edges by scraping through the cut just made and also to avoid marring the tooth finish. Simultaneously with this relieving action, the arbor carrying the work is automatically indexed one tooth in readiness for the following cut. On the completion of the last cut the machine is automatically stopped. Some of these machines were built by Sloan & Chase, and as you know this company is no longer in existence.

Due to the large number of different gears we have to cut, this type of machine has great versatility, and is easy and quick to change over. We have approximately 300 index plates that are very accurate, due to having been ground and checked on a Zeiss Optical Divisional Tester.

As an operator runs more than one machine, cost is expressed in loading and unloading time, without too much attention being paid to actual running time, and this type of machine allows the use of female labor under the direction of the group leader and set up man.

In addition to the foregoing semi-automatics, we have a battery of automatic gear cutters. These machines take the bar stock, turn a shoulder, cut teeth and are cut off.

The number of teeth cut on these automatics range from 12 to 15 teeth, and are from 90 to 120 D.P. The same

GET YOUR COMPLETE CONVENTION TRANSACTIONS

A bound booklet of aproximately a hundred pages, containing the verbatim reports of the entire A.S.T.E. Convention, 8 sessions, is being made up now.

This report will carry complete sessions including introductions, all questions, answers, and discussions.

The extremely valuable technical information contained, and the very low cost, make this something you will want and cherish as a valuable adjunct to you in your chosen profession. Prices given are cost or less. Only a limited quantity will be printed. To be sure of getting your copy —

ORDER YOUR COPY NOW

Name..... **Address**.....

Please check ☐ **Member** ☐ **Non-member**

Prices—Members—1 copy **$1.00**
Extra copies ..... **2.00 each**
Non-members, each copy **2.00**
Orders for 25 or more copies—write for special prices.

Tear out this coupon and mail with your remittance to

AMERICAN SOCIETY OF TOOL ENGINEERS, 2567 W. Grand Boulevard, Detroit, Michigan

methods for maintaining accuracy are used on the automatics as on the semi-automatics, as the cutters are projected, the indexes made and inspected in the same manner, and the product is projected likewise. These machines were manufactured by Sloan & Chase to Westinghouse requirements.

The second type of operation is on the 10 tooth pinion, 120 pitch, which is machined from bar stock so that the pinion is part of the shaft due to the small diameter making it impossible in our case, to have a separate pinion, so the shaft proper is rough machined on both sides of the pinion, the pinion is then cut and the shaft then cut off. This shaft is then finished on a turret watch lathe by machining both ends, making the pivots and forming the body of the shaft. These machines are of Westinghouse manufacture.

The third type of machine used is to cut the pinion on our disc shaft. This machine is fully automatic, and the shafts to be cut are magazine fed, the pinion is then cut, and shaft automatically ejected, and the cycle repeats. This type of machine is also of Westinghouse design and manufacture.

The second pinion cutting operation I have just described, that is, the pinion integral with the shaft, certainly can be improved by combining the finishing and machining operation with the pinion cutting, thereby, having the cycle completed in the same setup by a completely automatic machine. To the best of our knowledge there is no equipment available that can do this type of work, and we have conducted some negotiations, but to date have not reached a satisfactory solution. This, I believe, would be a field for investigation, as we believe there is quite a need for this, due to many small pinions having to be integral with the shaft, and if the complete operations can be performed automatically should prove their worth economically.

We use topping cutters and this makes for simple checking as the O.D. can be checked with a micrometer or ring gages and the correct depth, form and pitch line are being automatically measured.

The cutters are checked to a master outline at a magnification of 200 times, and these cutters are all Westinghouse manufacture.

The gears are cut on arbors and a further check is made by taking one gear from each arbor, and this is checked by projection method to a master, at 100 magnification.

Any wear and tear of the machine is readily recognized by small irregularities in the product when projected to 100 times.

This type of machine has few moving parts, and the construction is such that the repairs are easily and economically accomplished. (At this point a movie of the items already covered in this paper at the Westinghouse Meter Division was shown.)

The foregoing has outlined the manufacture of gears as accomplished at the Meter Division, but in order to try to cover a broader field we have received some information from various other gear manufacturers.

The Sperry Gyroscope Company, as we all know, have to have precision gears due to the type of product they manufacture and the following is some information which has been kindly furnished by them.

The pitch range in this plant is from 8 D.P. to 64 D.P. and the tooth range is from 15 to 360 teeth. The types of gears are Spur, Bevel and Spiral Gears. The tooth form is a standard involute 14½ and 20 degree pressure angle. Practically all types of materials are used in the gears at this plant. The majority of the gears are cut to a tolerance of plus nothing minus .002 on the pitch diameter. Gears which are used on mechanisms that require a closer tolerance, range down to plus nothing minus .0005 on the pitch diameter. The gear trains have to be very smooth running, and a series of approximately 6 gears must not have a total backlash greater than .001 measured at the pitch line of the last gear.

The machines used in this plant are the Gould & Eberhardt Vertical Hobber, Barber-Colman Horizontal Hobber, Small Mikron, Reinecker, and the Gleason and Bilgrim.

In extremely precise requirements where two or more gears must run together absolutely smooth and without backlash, they employ the use of a Fellows Gear Burnisher as a final correcting operation before assembly. The reason for using the gear burnisher is as follows:

Regardless of how careful settings may be made, or how accurate the hob may be, and the extreme caution taken to produce the gear, there will still be small infinitesimal errors in the gear tooth form which are inherent and cannot be remedied by the cutting method. The final correction and elimination of tooth form error and spacing takes place in the burnishing machine which uses three hardened and ground master gears in mesh with gear to be corrected set in center of the three being held by pitch diameter only. These gears are then rotated first left and then right with the desired amount of pressure to iron out or burnish the irregular surfaces and spacing of teeth.

In order to maintain this accuracy the projection method is used to check the form of the hob at 200 magnifications with the master. The first pieces from the setup are also inspected by the projection method to show the generated form of tooth. For the precise measurements of center distances and pitch diameters the super micrometer, Hoke Blocs, and Parkson gear testing machine are used.

The Mikron Hobbing Machine is a very important machine tool in this industry for the manufacture of small precision gears. It is of very good design, accurate and capable of high production. There is no American made machine to take the place of the Mikron and I believe there is a definite need for one.

Another field in which precision small gears are used is the camera and projection industry and the following information has been received from the Eastman Kodak Company,

The pitch range in this plant is from 20 to 125 D.P., with pressure angles from 10° to 20°. The 20° pressure angle full depth system is the standard with the exception of very fine pitch gears, where the 10° pressure angle is used. The number of teeth in the fine pitch series is from 10 to 60 teeth, and

(Continued on Page 60)

GET YOUR COMPLETE CONVENTION TRANSACTIONS

A bound booklet of approximately a hundred pages, containing the verbatim reports of the entire A.S.T.E. Convention, 8 sessions, is being made up now.

This report will carry complete sessions, including introductions, all questions, answers and discussions.

The extremely valuable technical information contained, and the very low cost, make this something you will want and cherish as a valuable adjunct to you in your chosen profession. Prices given are cost or less. Only a limited quantity will be printed. To be sure of getting your copy—

ORDER YOUR COPY NOW

Name..... **Address**.....

Please check ☐ **Member**
☐ **Non-member**

Prices—Members—1 copy **$1.00**
Extra copies ..... **2.00 each**
Non-members, each copy **2.00**
Orders for 25 or more copies—write for special prices.

Tear out this coupon and mail with your remittance to

AMERICAN SOCIETY OF TOOL ENGINEERS, 2567 W. Grand Boulevard, Detroit, Michigan

The Shaping Method of Producing Small Gears

(*Discussion*)—*Precision Small Gears*

By

GEORGE H. SANBORN

SALES ENGINEER
THE FELLOWS GEAR SHAPER COMPANY
SPRINGFIELD, VERMONT

THE users of fine pitch gears are legion. Every day, it seems, new devices using fine pitch gearing, in one form or another, are invented. Truly from the time we are awakened by the alarm clock to begin our day, until we again wind it up at night, knowingly or not, we make many contacts with appliances in which fine pitch gears play an important part. And we must not forget that most of us carry a delicate gear train with us in our vest pocket or have one strapped to our wrist in the form of a watch.

Fine pitch gears are made in a great variety of types and sizes from the tiniest pinion used in small wrist watches to the relatively large gears used in range finders. Each device has its own particular problems of manufacture. Some use stamped gears, and pinions are often made of drawn pinion rod, but by far the greatest preponderance of users need the greater accuracy afforded by cut gears. While still others have to resort to the generating methods of cutting their gears in order to achieve the best results. In this latter category one finds the precision instruments, dial gages, geared shutters for cameras, range finders, moving picture cameras and projectors and many other products too numerous to mention.

A survey of this field reveals many interesting things. For some reason the older devices such as watches, clocks, meters, and many instruments which by the way absorb by far the largest volume of these gears, use the epicycloidal system or some variation of it, for tooth form. While the later inventions for functional reasons use the involute system of gearing. This is very likely due to the fact that the equipment was inherited from the watch industry and tooth form design practice came with it irrespective of whether or not it best suited the application.

The clock and watch industries are highly competitive and one finds that many clock companies have equipment of their own design made to serve their particular production problems. This equipment is often guarded with the same instinct that a doting mother guards her maiden daughter.

Later inventions have taken advantage of the involute system, and several of the more progressive watch and instrument companies are now using involute gears. It is my belief that adoption of the involute system will spread generally, as its many advantages are fully appreciated.

Our standard machines in the past have been rather large for the class of gears which we are discussing here, but we were furnishing cutters and other special tooling for this class of work.

About five years ago we developed the gap type cutter which has proven very economical as well as improving the accuracy of the product. Many fine pitch gear users have taken advantage of this cutter and one of our customers showed over $20,000.00 saving the first years of its use. These gap type cutters are not only used for spur work, but also for helical gears.

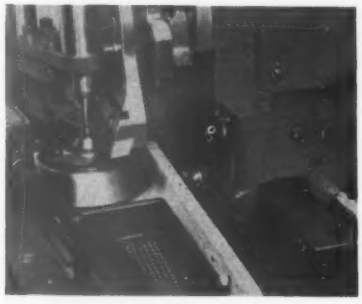
To answer the call for new American made fine pitch gear cutting equipment to give high production coupled with precision the F.G.S. Co. has developed especially for this purpose two new gear generating machines. The form cutting method cannot be expected to compare in accuracy with the generating method, especially in regard to accuracy of tooth contours, so the generating method was followed in our new developments. One of these machines is known as the Fellows "Straight-Line Gear Generator" and has a maximum capacity of 2" pitch diameter, and ¾" face width. The other machine is known as the Fellows "Fine Pitch Gear Shaper" and has a maximum capacity of 3" pitch diameter and ¾" face width. This machine can be employed for cutting both external and internal spur and helical gears whereas the "Straight-Line Gear Generator" is confined exclusively to cutting external gears. These machines have been equipped with automatic loading devices, etc., to obtain the desired production at low cost.

Slide — 1

The "Straight-Line Gear Generator"

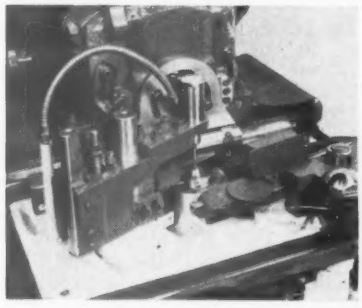
derives its name from the fact that it employs a rack-type cutter, which travels in a straight line. It differs from other machines employing rack-type cutters in that there is no intermittent displacement of the rack to complete the gear, the rack travel being continuous until the gear is finished. The rack-type cutter is carried in a clapper box type of holder, the latter being mounted on a swivel plate attached to a slide. The slide is reciprocated at speeds as high as 2000 strokes per minute.

Slide — 2



The rack cutter holder and swivel plate can be set for cutting both spur and helical gears. The rack cutter is made about 6⅜" long, or approximately the same length as the maximum pitch circumference of the gear which the machine will cut. For cutting smaller gears and pinions, the rack cutter is made with groups of teeth separated by gaps, the number of teeth in each group equaling the number of teeth on the work. The bed of the machine carrying the rack holder and slide is traversed by a lead screw, and change gears are provided to affect the correct linear travel of the bed relative to the work.

Slide — 3



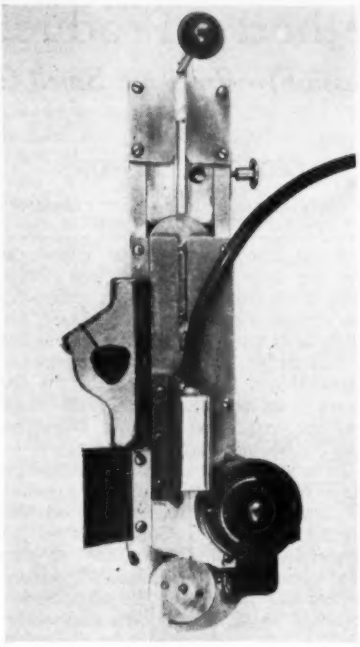
When this machine is equipped with a magazine feed and operates automatically, the position of the rack cutter relative to the work is controlled by dogs which operate the reversing mechanism that changes the direction of travel of the bed. These dogs can be set for short travels of the bed and at

any point within the maximum travel of the bed. For instance in the cutting of pinions having a small number of teeth, the cutter having several groups of teeth separated by gaps, the machine would be operated as follows:

The dogs would be set to use the first group of teeth at one end of the cutter, and the bed alternately traversed in both directions, a pinion being finished at the completion of each traverse. When the first group of teeth become dull, the dogs are shifted to the next group, and so on, until all groups of teeth have become dull. The gaps in the rack cutter permit loading and unloading the work without stopping the machine or withdrawing the cutter from the work. This machine can also be arranged for hand loading, in which case a limit switch at the rear of the machine stops the machine at the completion of the gear. The cutter life on this machine is greatly increased due to the cutters cutting in both directions.

Slide — 4

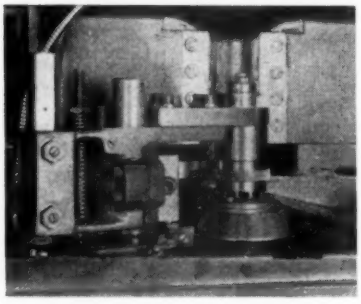
The "Fine-Pitch Gear Shaper" differs from the "Straight-Line Gear Generator" in several respects. In the first place a circular or pinion type cutter is employed and the process of generating is identical with that of the regular Gear Shaper. This machine, however, incorporates several interesting features which particularly suit it to small fine-pitch work. In the first place, the cutter-spindle is held in a relieving type of saddle, and is so designed that it is capable of extremely high reciprocating speeds up to approximately 2000 strokes per minute. The bed which carries the saddle and cutter-spindle assembly is adjusted along the base for cutting gears of different diameters. This machine, as well as the "Straight-Line Gear Generator," can be equipped with an automatic magazine feed to which we will now turn our attention.



Slide — 5

This shows the magazine removed from the machine. It is held on a three-cornered shaft, and is operated by a cam. The magazine is of box-section and is made to suit the character and shape of the work. It contains a "feeding" finger for holding the work when in position for loading, and a pressure slide which advances the blanks as they are removed from the feeding finger. It will be noticed that this magazine holds the work in the same position—vertically—that it occupies when in the cutting position, hence the shape of the part does not in any way affect the insertion of the work. It should also be evident that handling the work in a vertical position prevents the center of gravity of the part affecting its successful automatic handling.

Slide — 6

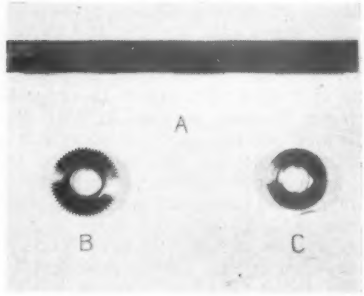


The work when in the cutting position, is clamped and supported by a support, elevated by a cam against spring pressure which exerts sufficient pressure to hold the work rigidly in place when the teeth are being cut. The type of support used is governed by the shape and character of the work. One method of holding and driving the work is here clearly indicated; this subject will be discussed more fully later.

At the same time that the work support is raised by one cam, a second cam, which is timed with the work-support cam, elevates an ejector which removes the work from the adapter, or work-spindle as the case may be.

As the work is elevated, another ejector working in conjunction with the work support is released to eject the work from the cutting position. In this particular case it is a flat spring. The magazine then swings into position for loading; the support lowers to clamp the work; the magazine withdraws, and the cutter comes into action. On the "Straight-Line Gear Generator," the cutter is traversed into depth; whereas, on the "Fine-Pitch Gear Shaper," the cutter is fed radially into depth. The cutter continues reciprocating when loading and unloading is taking place. A micro-switch operating a red light at the front of the machine, indicates when the magazine requires reloading. The machine also stops at this time, making it possible for one operator to operate a group of these machines.

Slide — 7



Previous reference has been made to the type of cutters used on these machines. The rack type cutter A, which is used on the Straight-Line Gear Generator is in this case made with several groups of teeth separated by gaps. This cutter is intended for cutting three different gears. The first group of teeth is for cutting a 40 tooth gear, the next 30 teeth, and the last two groups for 11 teeth each. The particular cutter illustrated is 100 pitch.

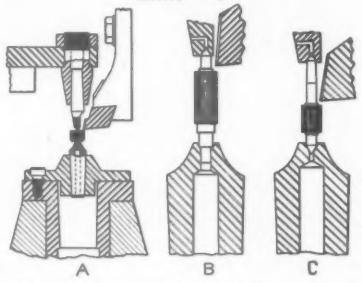
One might assume that this type of cutter was unpracticable due to the fact that a different cutter is required for every number of teeth. This, however, is not the case, as a 30 tooth cutter, for instance, could cut any gear of 30 teeth or less. As these teeth on these rack type cutters are form ground they can easily be made of non-involute shape and also topping.

The circular cutter B is the type used on the Fine-Pitch Gear Shaper. This particular cutter is 48 pitch. The cutter C is 98 pitch. It is not so long ago that 32 pitch gear cutting tools were the finest that were being accurately ground. Then came 48 pitch, 60 pitch and finer. Now we are grinding 125 pitch from the solid to a very satisfactory accuracy, and will in the near future grind to approximately 200 pitch.

Gears produced on these machines are within close limits of accuracy both for involute profile, and tooth spacing. A good example is gears for range finders where it is necessary for the fourth gear in the train to have such uniform motion that at no time will it be mispositioned more than one minute of arc. This introduces an entirely new aspect into the fine pitch gear field.

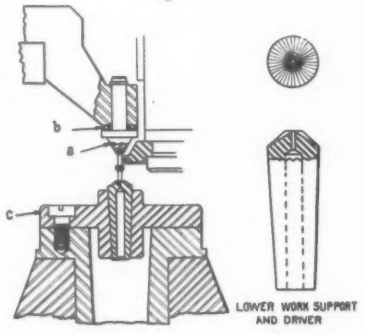
The cutting of fine-pitch gears presents several interesting problems in connection with methods for holding and driving the work. In some cases the work is so small and slender that the question of clamping pressure, as well as cutting pressure, are factors that must receive careful consideration. In many cases, as well, the shape of the work is such that ordinary holding methods are not feasible. We will show a few examples of work to illustrate principles in this connection.

Slide — 8



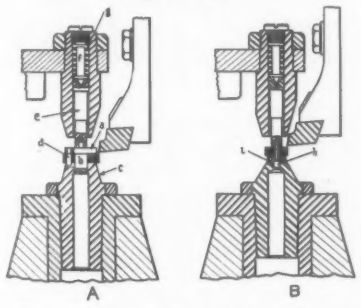
This illustrates three different types of gears and presents methods for holding. At A is shown a small gear having extended shafts on both ends, one end being cone shaped and the other having a square shoulder. Due to the small area of contact, a dead center can be used for supporting the upper end of this blank. It is driven at the lower end by serrations which drive from the small shoulder, this being more clearly indicated at B. At C is shown another gear with cones on both ends. The driving is done with a serrated cone as indicated.

Slide — 9



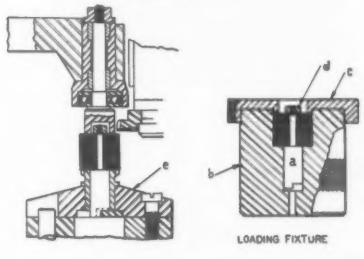
This illustrates another stem pinion of a delicate nature and with a comparatively small driving area which is insufficient to afford a drive against any considerable amount of friction. Therefore the suggested method for handling this work is to use a live center "a" in the upper support with balls "b" to take the thrust and to reduce resistance to rotation of the work. Attention should be drawn to the type of work holder at "c". This is of the "floating" type which presents not only an economy in manufacture, but also enables the lower workholding member to be very accurately centered.

Slide — 10



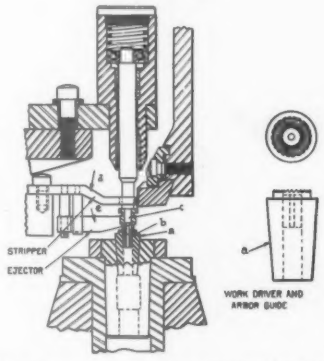
The cutting of thin blanks also presents a problem, because it is generally desired to cut several blanks at one time. Therefore, some sort of holding or loading device must be employed for properly aligning the blanks as well as clamping them when the teeth are being cut. Two suggestions for handling work of this nature are shown at A and B. The arrangement at A is for handling five blanks at a time, and is for hand loading. The holding outfits consist of a plate "a" carrying a stud "b", the lower end of which is a close fit in the holder "c". The work to be held is provided with a hole, in addition to the center hole, and this can be used both for locating and driving. Plate "a" carries a stud "d" fitting the holes in the blanks and extending to a slot in holder "c". This stud "d" therefore, acts as a driver. The work is supported at the upper end by a plunger "e" mounted in bushings and acted upon by a cone-shaped plunger "f" and compression spring "g", pressure of which keeps the work tightly against the work support "c". At B is a similar arrangement, but in this case the hole in the work is much smaller, and in addition, has no additional hole that can be used for driving purposes. Therefore, the work is forced on to the slender arbor "h" in an arbor press, and the lower plate of the fixture carries a pin "i" which acts as a driver, as in the previous case.

Slide — 11



Other suggested methods for handling thin blanks are shown in this slide. These blanks are so thin that it was felt that forcing them onto the arbor in an arbor press would not guarantee a sufficiently tight fit, and that some of the blanks might also have holes slightly larger than others, and consequently, an additional clamping means was desirable. A loading fixture was also considered advisable, because of the nature of the work. This is shown in detail where it will be noted that the work arbor "a" is placed in the loading fixture "b", the work inserted over the small stem of the arbor, and then tightened by screwing down the cap "c". The work is then held in place by nut "d". It will also be noticed that the lower end of the arbor is slotted and is driven by a key in plate "e". Owing to the fact that this arbor could not be supported directly at the top, it was felt that considerable clamping pressure would be necessary. Therefore, a ball thrust bearing was inserted into the arbor support so that considerable pressure could be exerted, and at the same time resistance to rotation reduced to a minimum. In other words, the arbor support was made to rotate with the work.

Slide — 12

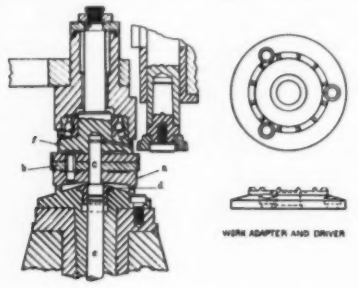


Here is an interesting means for handling a small pinion having a comparatively small hole. In this particular case, because the part was to be handled by magazine feed—not hand loaded—the conventional method of holding on an arbor could not be employed. Therefore the arbor support was used as an arbor as well. It will be noticed that the lower serrated driving bushing "a", as shown in the detail view, carries a locating bushing "b", which accurately fits the lower stem of the arbor "c". This arbor, it will be noticed, is supported in bushings and at the top end by a ball bearing, also a compression spring to exert sufficient clamping pressure to drive the work through the serrations. When the gear has been completed, the arbor support rises and in doing so, of course, carries the work with it so that a stripper "d" is provided to eject the work from the arbor. At the same time that the work is ejected from the arbor, another ejector "e" removes the work from the top of the work adapter.

Slide — 13

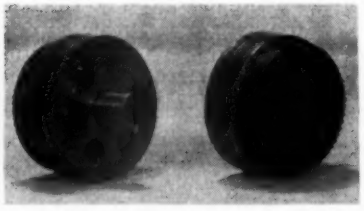
In handling work which must be fed to the machine automatically through

a magazine, it is of course impossible to use any clamping means other than that which can be handled automatically. This slide shows an interesting adaptation of this principle. Here two blanks are being cut at one time and are held on a locating holder "a". The blanks "b" are provided with a hole in which a stud can be used to act as a



driver. This also shows an interesting application of the face gear. The adapter shown in the detailed view is provided with several knife-edged teeth and the lower end of the work holder "a" with similar teeth in the form of a face gear. These teeth mesh with each other when in the driving position and have the added feature that they not only drive the work, but automatically center it as well. Therefore, the adapters, of which there must be one for every two gears fed through the magazine, can be handled automatically through the magazine without any attention on the part of the operator. These work holders "a" are provided with a stud "c" which is located at the lower end by bushing "d", the latter being held in a "floating" fixture. The work-holding outfit is ejected by a plunger "e" after the teeth have been cut. Arbor "c" is supported at the upper end by a ball bearing mounted locating member "f". The arbor support, of course, is raised automatically when the work is to be ejected from the machine.

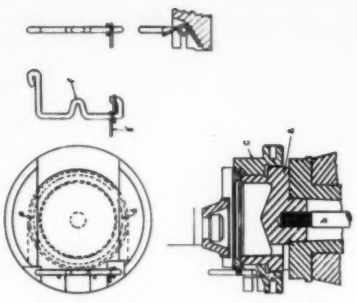
Slide — 14



This shows another type of work holder for holding a number of thin blanks at one time. The blanks are located by a pin as illustrated and the outfit is provided with face gear teeth which act as drivers. The work holders are automatically fed through the magazine.

Slide — 15

The "Fine-Pitch Gear Shaper," which uses a circular type cutter, is adapted to the cutting of both internal and external gears. This slide shows an in-

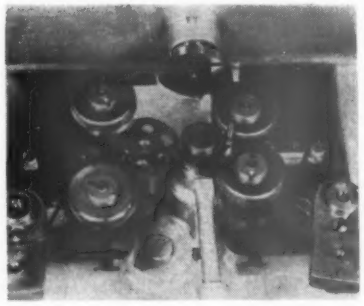


teresting application of this machine for the cutting of small internal gears. The fixture illustrated here, which is hand-loaded, incorporates several interesting features. An adapter "a" is held in the work spindle by a clamping bolt "b", and screwed to this adapter "a" is a clamping plate "c". This is slotted on the upper face, as shown in the plan view, so that it only contacts the work at the points "d" and "e". To assist the operator in properly aligning the work in the fixture while it is being clamped, a spring actuated pressure finger, shown in detail at "f", is employed. This is pulled down by the operator against the tension of the small spring "g", the blank inserted and then the spring automatically returns and presses against the work to hold it tightly in place while the nut "c" is being tightened.

Slide — 16

Gears for sound propection apparatus are being produced where minute variations in angular velocity cannot be tolerated. Frequencies as high as 8000 per second are in use. Incorrect tooth conjugation disturbs the uniformity of film travel, which in turn, distorts the sound photographed on the film. Also in these cases smoothness of gear action is important from the standpoint of noise. To meet such requirements we have developed a burnishing machine especially for fine-pitch gears. This is known as the Fellows No. 4B-Gear Burnishing Machine. This burnishing operation is not to correct errors in profile or spacing, but to smooth the surface of the teeth, which, in turn, makes them smoother running and quieter in operation.

Slide — 17



Burnishing two gears at a time makes it possible, when necessary, to burnish a mating pair of gears at the same setting. As the burnishing action is the combined result of speed, or time, and pressure, both gears can be rotated at the same speed, and more pressure used for burnishing the larger gear, thus accomplishing the desired result in the same time on both gears.

The more we investigate this interesting subject of fine-pitch gearing the better we appreciate the developments that must be perfected to meet the insistent demands for greater accuracy at lower costs. The foregoing remarks should be considered more in the nature of a progress report rather than the last word on this important subject.

DETROIT TO HAVE MACHINE AND TOOL PROGRESS EXHIBITION IN 1941

The recent meeting of the American Society of Tool Engineers in New York City was the largest of its kind ever held. While members and Tool Engineers were in technical sessions throughout the day of March 7th, the A.S.T.E. National Board of Directors, supreme governing body of the organization, was also in session to conduct the business affairs of the Society and to pass on many important steps to be taken in the year to come.

One of the most important decisions made was that pertaining to the next A.S.T.E. Machine and Tool Progress Exhibition. After much debate and considerable discussion, Detroit was selected as the place for the next "show" and March, 1941 as the date. Plans were also made for an even larger and more comprehensive Exhibition, based on the past successful "shows" put on by the A.S.T.E. in 1938 and 1939.

The Hobbing Method of Producing Small Gears

(*Discussion*) — *Precision Small Gears*

By
S. M. RANSOME
BARBER-COLMAN COMPANY
ROCKFORD, ILLINOIS

THIS is a symposium, and we represent, as has been intimated, the hobbing side of the question. In 1934 and 1935, our Eastern representatives became more and more vocal about the subject of a hobbing machine for smaller gears than we were equipped to take care of at that time. Then around 1936, we discovered that one of our customers had on his own initiative developed a hobbing machine. He is a large clock manufacturer who manufactures hundreds of thousands of clocks. Together with his engineering force he developed a small automatic hobbing machine. Our representatives brought this to our attention and asked us if we wished to take the matter up with this gentleman as he was not anxious to manufacture, and he wanted us to take it over, if we would, and this we did.

In the year 1936 we developed this machine, or started to develop it — it is still being developed and I suppose will continue like other machines for the next twenty or thirty years. But to begin with, we built a machine in 1936 and threw it away. In 1937 we built some more which we felt represented a good effort in the nature of a small automatic hobbing machine, especially for the purposes we have been hearing of already. Just by way of still further introduction I would like to remind you, those of you who have been in the hobbing business I think will be familiar with these pictures, we just use it to illustrate our point and to lead up to the further subject.

Slide No. 1

This shows our larger machine. We built this in two sizes for many, many years. I think we have been producing this machine about thirty years. We have about 2,000 of them in the field, the field being the world, and they are well scattered over that part of the world which uses this size of hobbing machine.

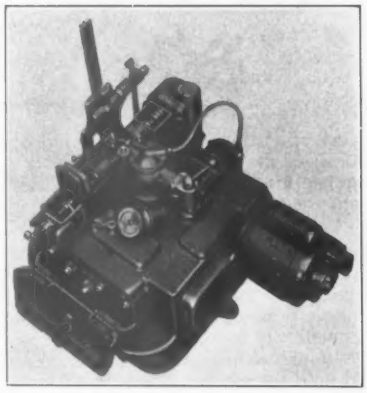
We build this in two sizes which we call our No. 2 and No. 3. We found that these machines, while they were very useful and very widely sold for certain gears—when it got down to the very small gears, gears below, say, a quarter of an inch in outside diameter, from there on down, these two sizes were probably a little too large. For that reason, we were anxious to cover the field as far as we could, so we decided to go into this question and took over the machine design from this customer of ours and developed a machine which we call the Type S machine, which is a fully automatic hobbing machine, that is, a magazine feed type of machine, although it can also be used as a hand feed machine. The slides that follow will be mostly concerned with this machine, this being the main topic of this discussion.

Slide No. 2

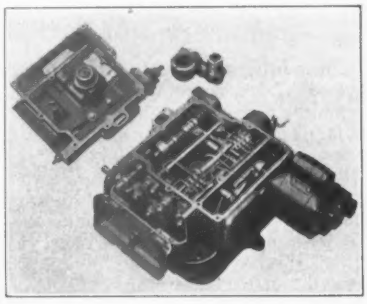
This shows you an outside view of the machine, which is a small compact machine. I have not the exact dimensions with me. The machine weighs about 300 pounds, slightly over, and is about 18 inches or so square, and about 12 or 14 inches high. It has been largely mounted on benches by our customers. We have a few dozen of them out in the field and have a number more on order. We have had quite an experience in bringing out this machine.

Slide 3

This shows a little more of the machine, showing some of the construction as seen from the top, more or less of a plan view. You can see the driving motor at the rear. This is a motor-driven machine, with a Fahnestock motor built on the end of the machine and on the back of the machine. This gives you some idea, as I say, of its construction.



Slide 4

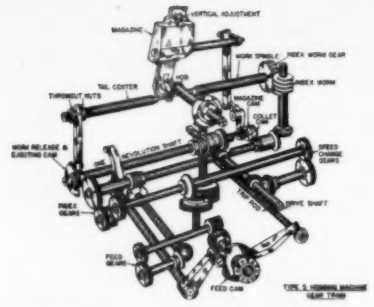


The machine as we built it is outfitted with a lubricant pump and a cooling pump. Those small pipes which you can see are the pipes which take the lubricant to all the main bearings of the machine. The machine is almost entirely automatically lubricated, which we felt was rather necessary for such a small type of machine. So we built a lubricating pump into the design. And I might say we have recently improved this lubrication system to make it more positive and more effective than it had been before. We lead the lubricating fluid to practically every main bearing where shafts run at any speed in any part of the machine.

Slide 5

This view gives you a schematic view of the machine, showing the various shafts and gears. In fact, almost every moving part on the machine is shown in this view.

You will notice the feed cam at the foot of the picture. That feed cam is made so that it can be easily removed and a separate feed cam is used for every different kind of job. This gives



us an opportunity to give a rapid approach of the work to the hob, and to regulate the amount of feed to be used, then, again, the rapid return to the starting point.

This picture also shows our rocking type of magazine. The work is fed in at the top of the magazine and falls into a stack provided, and it is from there automatically fed out between the centers, which at the proper time come out and hold the work.

While I am at this point I can appreciate the remarks of our preceding speaker in regard to the holding means, because if you wish to increase the consumption of aspirin in your neighborhood just start a few men working on devices for holding some of these little pieces. You will find it is a very intriguing problem which offers considerable opportunity for ingenuity in design.

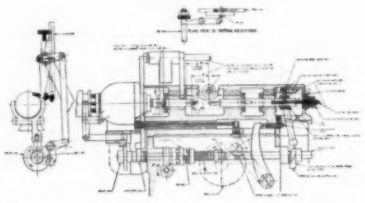
Our men were possibly a little handicapped in this respect not being New Englanders, or even in the East, and not as familiar with the clock and watchmaker technique, perhaps, as the folks in the region nearer to the Eastern seaboard where this type of manufacture has been carried on more extensively. But we are past that stage to a great extent. We have now been working on these things for two or three years, and we have had problems from most of the clock and watch manufacturers of the country.

We have installations of machines in Oklahoma as well as quite a number here in the East, and also, of course, in the Middle West. We feel that we have developed a technique which enables us to take care of holding most of the types of work which are brought to us as problems in hobbing.

The machine is very flexible. We can design the cam and arrange the chain gears quite readily, the feed gears on the left, and the speed change gears on the right to give various cycle times, that is, the time in which one part will be completed. I think about the shortest cycle time we have gone into so far is about 12 seconds, and we often have an opportunity to use a longer cycle time than that, depending, of course, on the size of the gear, the number of teeth, the width of face, and the material of which the gear is composed, and similar elements of the problem. We also have the opportunity of changing our ratios quite readily on this machine. We have a complete set of index gears which can be readily changed to any given number of teeth, any number of teeth required. We have this as an advantage over the milling type of machine, which requires a plate, of course, for every number of teeth, or at least a multiple of the same, required to be cut. We simply take care of any number of teeth by putting on the suitable change gears.

We also have an advantage in the hobbing system which is common to us, and the shaping system, too, having used the same cutter for any number of teeth, from a small pinion to larger proportions of teeth. We found this was very much appreciated by one of the largest meter manufacturers in the country. He had been forced, every time he made an experimental meter with different numbers of teeth to get a cutter. When they found that we could provide one hob, of course, of one pitch, which would take care of all the numbers of teeth for this experimental work, they very promptly proceeded to put in a machine, and go into the hobbing field, which they had not been in before.

Slide 6

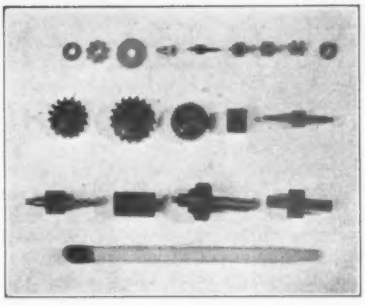


This is a section showing you in some detail the construction of what we call our work spindle. The work is located approximately in the center of the various lines that you see. There is a little view up above which shows a plan view of the cam and of the trip mechanism. Really, there is too much here for us to go into in much detail in the time at our disposal. We just illustrate this to show you the operation of our cutter. The cutter or the hob can be seen in the center of the picture. It is located on the horizontal axis. The work is located below the cutter so that when the centers are retracted and the knockout pins are pushed toward the center, they knock the work out from both directions, and it falls down into that pocket and rolls from there out into a chip fan provided.

We also have a one-revolution shaft which you see down below that actuates our indexing mechanism which in turn actuates the cam. This particular picture shows a collet type of holding means which is not exactly standard with us, though we provide it when it is required. We make use of various types of holding means which I will try to show you in a few moments.

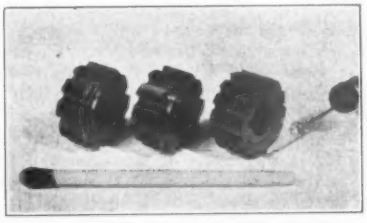
Slide 7

This is a picture of a few of the jobs we have done. These are all customer parts. The one at the bottom is put there for proportional purposes. It is just a common or garden match. I don't know whose idea this was, but I think it is a good one. It gives you a very clear picture of the size or lack of size of these



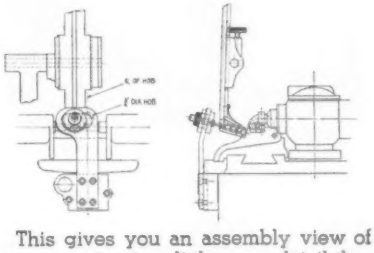
parts. You know, they have some parts at the clock companies, and especially the wrist watch manufacturers, which are liable to get under your finger and thumbnail. These are not quite as small as that, but they are not so very much larger. Some of these small ones are not much over, I would say, .040 outside diameter. These are all jobs which we have done and which are in production in various plants throughout the country. That is not all we have done but it is just a selection that we happened to be able to scrape together in time for this paper.

Slide 8



This shows a picture of the hobs which we use. These hobs are made usually three-quarters of an inch, sometimes seven-eighths in diameter, and from three-eighths to a half-inch face width. I am glad to say we have one on the Fellows Gear Shaper folks for the moment, because we have gone a little higher than they have in grinding and producing these fine pitches, but maybe that is not even true by this time. We have been grinding 180 pitch, and we have produced 205 pitch, by the machining method, or, as we call it, the formed tooth, that is, a tooth which is formed with a tool but not ground. We have ground 180 pitch and it is quite possible we will be grinding 200 pitch before very long. But at the present time our figures stand at 180 and 205 diametrical pitch. The match again shows you how small these little hobs really are.

Slide 9



This gives you an assembly view of our magazine in a little more detail than

Stepping Up Production with the Warner & Swasey Adjustable Knee Tool

● If you have short bar work or small chucking work on your turret lathe, you, too, can save set-up time, indexing time and production time with this tool. With the improved stub bars and cutter heads, you can combine boring operations with turning and chamfering cuts. To set the tool, take a trial cut, mike it — then adjust with the graduated screw and start turning.

The photograph above shows this *adjustable* Warner & Swasey Knee Tool on a No. 3 Universal Turret Lathe at Cummins Engine Co., Columbus, Ind. The drill held in the center hole of the tool is chamfering the end of a fuel pump plunger barrel while the *adjustable* cutter simultaneously turns a short diameter. Accurate work and profitable time saving!

ORDER THIS NEW WARNER & SWASEY ADJUSTABLE KNEE TOOL

by mail for immediate delivery.

1¼" dia. turning capacity. 1" shank.	2" dia. turning capacity. 1½" shank.	3" dia. turning capacity. 1¾" shank.
Price $35.00	Price $35.00	Price $40.00

F. O. B. Cleveland. Sold on 30 days' approval.
Important: Specify shank size to fit your turret lathe.

Order this tool — use it for 30 days. Blank or finished bushings can be furnished for adapting drills and boring bars to the center hole at slight additional cost. Mail your order to Warner & Swasey, Cleveland, Ohio.

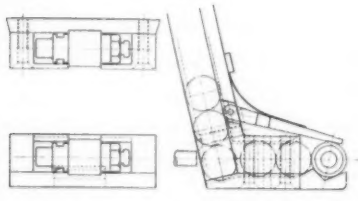
YOU CAN TURN IT BETTER, FASTER, FOR LESS WITH WARNER & SWASEY TOOLS

WARNER & SWASEY
Turret Lathes
Cleveland

we were able to show in any of the other pictures. You will notice the reservoir of the magazine is vertical, but it has an almost horizontal component at the bottom, and as the magazine swings outward, that is, to the left, after placing a piece between the centers, there is a vacancy in that "V" block which you can perhaps see at the mouth of the magazine. That little round pin is stationary, and as the magazine swings backward it impinges upon the row of pieces and positively pushes the next one forward into that little "V" block ready to be carried forward between the centers at the next cycle.

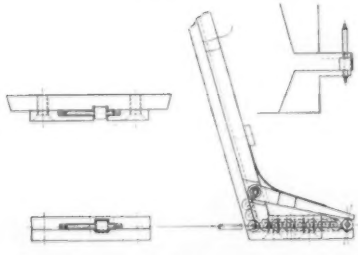
We had a great deal of trouble with these magazines, to begin with, because some of the pieces were so small that they would be held up by oil and a small chip or anything else would seem to prevent them from moving along as freely as we wished. So we made this positive arrangement which insures the blanks being definitely and positively pushed out into the mouth of the magazine ready to be grasped then by the centers which come out from one side, usually, and hold the piece while it is being hobbed. The magazine, of course, then is retracted and the hobbing operation is performed.

Slide 10



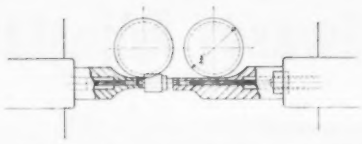
This shows another magazine. You can see the piece over on the left here. The only reason we show this is to show the different types of slides we have to make or paths for the various kinds of parts to slide down on their way to the hobbing operation.

Slide 11



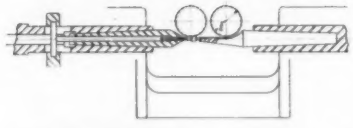
This shows another piece, rather of a different shape, and also shows where we have been forced into the same line of endeavor that has been referred to already, that is, although the picture is not clear on that point, this really shows a multiplicity of thin blanks which are held out of the machine, mounted on a small arbor and locked with that nut, as shown, and then the whole assembly is put in the magazine and from there fed into the machine.

Slide 12



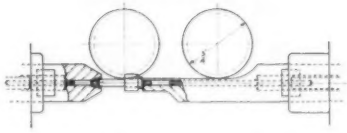
Now we have to finish up with a few samples of holding equipment. As we mentioned at the beginning, this matter of holding is the most difficult and probably the most vital part of this whole process, and in many cases we have gone to almost identical methods for holding the parts to the slide which have already been referred to elsewhere in this issue. We have to do many of the same things. These were not copied, I might say, but developed independently, although they may look in some cases as though they were almost duplicates. We were forced by necessity to use almost the same methods.

Slide 13



This shows another piece of work held in the small hole at one end and driven—although the picture is not very clear — most likely serration on the small round projecting part shown on the left. I might say the part you see shaded, or the cross-section on the left, is the rotating work spindle which revolves the work. The upper circle in each case represents the hob, and the right-hand side cross section part corresponds to the tail center in a lathe or any other machine tool. That part is supported on its two spindles or axles at the two ends and driven, as I said, most probably by serrations on the end of the driving nose of the left-hand member there.

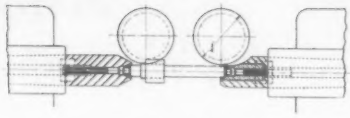
Slide 14



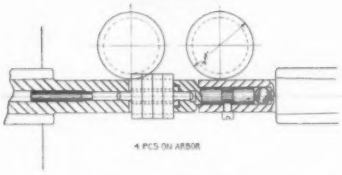
This particular piece is driven by internal tapered serrations referred to already. It is about the only way you can hold some pieces. Those tapered serrations are on the inside of the work spindle nose, or the part that fits into the work spindle nose, and as the work is pushed in by a spring from the other end, those serrations ride on the shoulder as shown, and the other part revolves freely in the hole and the piece is thus held sufficiently rigidly to be hobbed.

Slide 15

Here we have a very similar one, except that the shape of the piece is a little different and we have a little different system on the right-hand end. We have in some cases also had to provide a floating or rotating center for the tail center. Sometimes we have done it by just a plain sleeve and sometimes by using a type of ball bearing to reduce the friction and permit the piece to be more positively driven from the other end. This piece again is driven by tapered serrations.

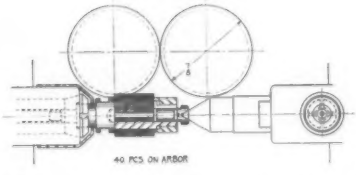


Slide 16



This shows a multiplicity of parts, plurality, or whatever you may term it, mounted on an arbor prior to being inserted in the magazine. Those parts come down in a little group as this particular piece is splining, and those little arbors on which the pieces are mounted are splined to fit, the pieces are pushed on to the arbor, put in the magazine, and hobbed as a group in this case as shown. There you see very clearly what I just mentioned about it. We use the balance in the rear end there which gives us a freely rotating rear center or tail center. That screw, of course, is to prevent the center from coming out when the center is retracted. You also see a knockout pin on the left which pushes the arbor out of the center when the other center is withdrawn and permits the assembly of pieces and their arbor to fall into the chute just below.

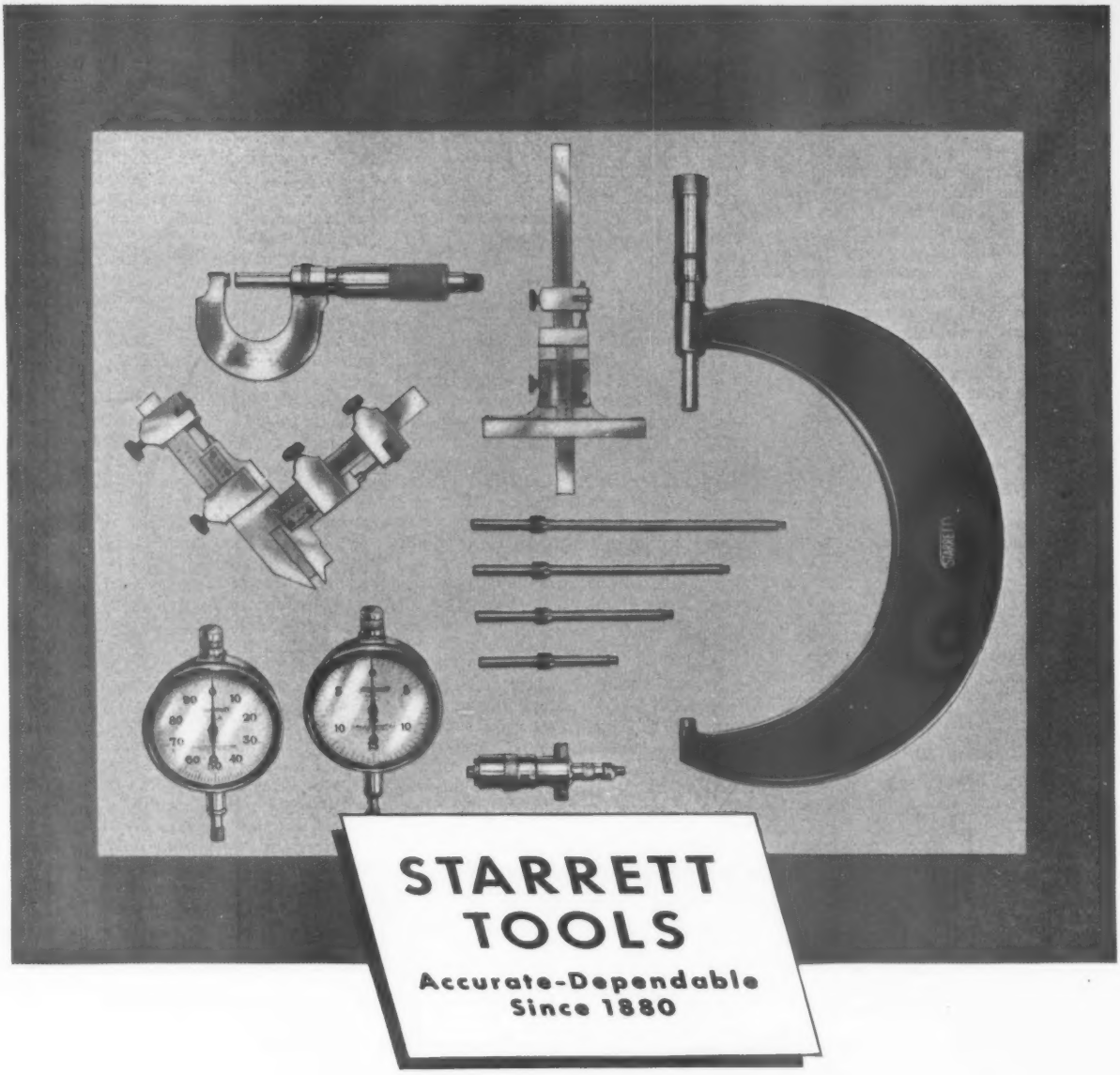
Slide 17



This shows a large number of thin gear blanks mounted on a little arbor with a nut by hand on a bench, and then inserted as an assembly into the magazine, which in turn feeds the whole assembly into the center that is shown there, permitting the hobbing of, in that case, 40 pieces as one load. That again is held in a collet and the pilot on the arbor is held by a collet in the little work spindle there, and when that is released and the ejection pin moved to the right the parts there fall into the chute.

Slide 18

This shows a somewhat similar setup except that we were able to drive the pieces one from another. This has not proved always successful. The vari-



STARRETT TOOLS

Accurate-Dependable Since 1880

The universal preference for Starrett Tools is based on years of never failing service and satisfaction. For a description of the complete line of Starrett Tools, consult Starrett Catalog No. 26-T.

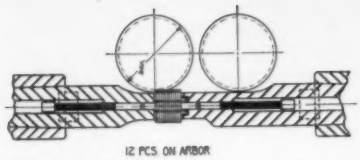
THE L. S. STARRETT CO., ATHOL, MASS., U. S. A.

World's Greatest Toolmakers—Manufacturers of Hacksaws Unexcelled—Steel Tapes, Standard for Accuracy
Dial Indicators for Every Requirement

Standardize on

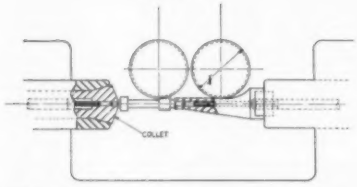
STARRETT TOOLS

BUY THROUGH YOUR DISTRIBUTOR



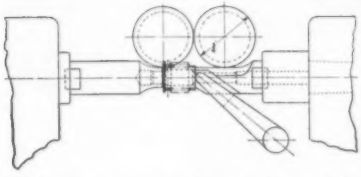
ations in friction and holding sometimes make it rather inadvisable to use this system, but where it can be used, of course, it is more rapid and cheaper to hold the pieces in this way, just by end pressure of the tail center and serrate the driver on the other end. But if you are not careful, if the proportions are not right, we have found there is a danger that some of the blanks will turn during the hobbing process and interfere with the spacing of the teeth.

Slide 19



This shows another setup, showing a collet in this case, the collet holding on to the work itself, the rear end or right-hand end of the work being held in a small hole in the tail center.

Slide 20



This shows one other feature which we have found necessary, that is why we show this picture. That is an ejector arm which pushes those strip pieces off the arbor or tail center when the tail center recedes. We have found this necessary in some cases because the work would travel back with the tail center and still stay in there and, of course, be in the way when the next piece was inserted.

I know there are some questions which could be asked, and I want to answer one or two of the main questions which might be asked. One of the first questions is this: What is the accuracy with which these small gears can be hobbed? In answer to that I would say that up to a half-inch diameter of gear can be hobbed without much trouble to .2 tooth-to-tooth spacing and .4 non-adjacent tooth error, the plus or minus error of any pair of teeth not to exceed .4. I might say we had considerable experience with this in the moving picture sprocket industry to which we have sold a large number of our larger machines. They required extremely accurate spacing on the sprockets used for propelling the film in moving pictures, and we brought out our precision machine for that purpose. That is what we would think very good, and this particular Type S that we are referring to, is .2 adjacent and .4 non-adjacent, or cumulative, as it is sometimes called, tooth error.

The next question that, of course, arises is, What about production? That is a hard question to answer. I would answer it this way: Production may run from 100 to 2,000 pieces per hour according to the size and type of piece, number of teeth, material, and other factors. The 2,000 is not to be understood as being 2,000 cycles of the machine, but as a figure to be used when we can mount a multiplicity of parts on an arbor and cut a large number in one cycle.

Another question and the concluding one which I know a number of you have in mind—would be the economy—when I say "economy" I not only refer to productivity of the machine, but to the productivity of the hob. I will just give you a few representative figures on what we term hob life, and let me say, to make it simple, we figure hob life as the number of linear feet of tooth of which a hob is capable. The highest record that I have received—it may not be the highest, but it is the highest I have at hand—is a matter of 58,500 linear feet. That is from a hob of ¾ inch diameter and ½ inch base. That is equivalent to about the length of Manhattan Island. That is, a hob such as we mentioned could produce one single tooth in clock brass as long as Manhattan Island before it was used up.

I have another figure for phosphor-bronze. This refers to a 94 pitch hob, by the way. You see, we use the hob in one position and measure the dullness over the number of teeth produced and then multiply by the number of sharpenings, the number of settings of which the hob is capable to get these full figures. For phosphor-bronze we have a figure of about 30,000 linear feet of tooth. For steel I have one figure of around 6,000, and another one of around 12,000. They happen to be different pitches, and probably the steel was at a different cutting state between these two figures. Then I have one further figure to show you how the material influences the life of a hob, where we were hobbing drill rod parts for ourselves, by the way, and also hobbing 61 95, which some of you may know is about the hardest and toughest and strongest material which you can get to machine, almost. The only one that I know that might exceed it would be 52 100, or ball-bearing steel. This 61 95 is just about as bad. When you get into hard, tough, strong materials like that the hob life drops very rapidly, and we would only get, possibly, on such material, a matter of 1300 or 1500 feet, linear feet, for the life of the hob.

We don't want to give you any false impressions because we would only be hurting ourselves by doing so. These figures are actual production figures, and whether they are exceeded or not, of course, may depend somewhat on conditions, but we offer them to you as data which we have collected.

Visual Machine Finish Standards

By
O. W. WINTER
PAST CHAIRMAN, BUFFALO CHAPTER, A.S.T.E.

MUCH attention has been given relatively recently on the subject of Machine Finish Measurement and Standards. Such instruments as the Profilometer have definitely taken their place as a machine shop tool. R. E. W. Harrison of Cincinnati Grinders did some pioneering work on the subject in 1929.

This was primarily in connection with ground surfaces, however. The measuring device used was an electro-magnetic sound detector; or pickup such as used on electric phonographs, which picked up the vibrations of a phonograph needle as it moved over the work and put it through a loud speaker as sound, or registered as current on a millivoltmeter.

Several years later E. J. Abbott developed the Profilograph and later the Profilometer. While such equipment is excellent for ground, or otherwise relatively smooth surfaces, it, nevertheless, is too delicate and not intended for turned surfaces, etc.

Even if one can afford a Profilometer there still exists this problem of standardization of turned, planed, and milled surfaces. Likewise, there still remains the task of establishing surface quality standards and the manner in which they are produced. The method of producing these surfaces, i.e., the feeds, tool radius, wheel grit, etc., used is quite important and must be definitely established so that the shop has something definite with which to work to produce the required finish.

To begin with a product really is not completely designed until definite specifications are laid down concerning machined surface quality. Not all engineering departments are capable of setting such specifications alone. This

(Continued on Page 54)

The Human Side of Tools!

KEEPING THE "BUGS" OUT!

The need for proper tooling is never so apparent as when getting a new product into production. It's a time that calls for cautious tool buying—for the helpful advice of tool engineers whose recommendations are qualified by years of practical experience in major production industries.

On many occasions, the Illinois Tool Works has helped manufacturers in suggesting changes in tool design or heat treatment that were a vital factor in smoothing the path of production for a new product. When such tooling problems arise, there's no substitute for experienced counsel—another important intangible so essential in the making of better production tools.

ILLINITE

HIGH SPEED PRODUCTION TOOLS

Milling Cutters
Ground Hobs
Broaches
Shaper Cutters
Ground Form Tools
Special Tools
Die Filing Machines
Gear Measuring Machines

ILLINOIS TOOL WORKS

MANUFACTURERS OF HIGH SPEED PRODUCTION TOOLS AND SHAKEPROOF PRODUCTS

2501 N. KEELER AVENUE, CHICAGO, ILLINOIS · IN CANADA: CANADA ILLINOIS TOOLS, LTD., TORONTO, ONTARIO

Copyright 1940, Illinois Tool Works

Production Perspectives

News of Mass Manufacturing from Everywhere

GOVERNMENT statistics revealed recently that aircraft, transportation and communications industries enjoyed a business boom in 1939. Figures released by the Civil Aeronautics Authority, the Commerce Department and the Federal Communications Commission showed railroad freight revenue in 1939 increased $395,000,000 over 1938 and passenger revenue increased $12,000,000. **Shipments of aeronautic products set a new high for the aviation industry,** with an export valuation of $117,081,212. Production of aircraft for domestic civil use increased 105 per cent. Operating revenues of 90 major communication carriers for the first 10 months of 1939 amounted to $1,012,700,000 compared with $962,000,000 for a similar period in 1938. Net operating revenues for these carriers were up 12 per cent.

Details of a forty-two-and-a-half million dollar preparedness program which directly affects their business were given at Del Monte, Calif., recently, to iron, steel and allied industry leaders by Lieutenant Colonel Welton J. Crook of the United States Army. Lieutenant Colonel Crook spoke on "Cooperation With the United States Army for National Defense" at the conference under the auspices of the California State Chamber of Commerce, and which continued through Feb. 10. "Our governmental arsenal facilities, although adequate for many peace-time requirements, are entirely inadequate for war-time needs," Crook explained. **"In the United States the war-time load must be carried by a private industry whose civilian occupation is only partly, and many times not at all, related to the tasks it will be called upon to perform in time of war. In order that industry may prepare itself to cooperate with the Army in defense of the country, it is necessary for it to acquire an education so that it may be able, quickly and efficiently to turn to the new tasks which will arise in time of emergency.** To this end the bill for 'educational orders' was passed. Under this act, the Secretary of War is authorized to place with industry educational orders for certain specialized types of munitions the bulk of which will have steel as a component. So far only six specified items have been selected but more will be added and the total appropriations for the five-year period amount to $42,500,000." Otherwise the present European war will have little effect on "purchasing trends for 1940," in the opinion of James MacPherson, manager, purchase and stores department, Standard Oil Company of California. **"There could be something which happens in the spring of the year of such intensity among the belligerents as to cause external conditions to assume greater importance than internal," he admitted. "Nevertheless, a sane thought is to assume that history may repeat itself. That is, for 1940 we will run along about as we did from August, 1914, to September, 1915, meaning that we will have slight irregularities in prices but no consistent general advances."** That industry has an internal war to fight against excessive governmental control was stressed in talks by James F. Lincoln, president, Lincoln Electric Company, Cleveland, Ohio, and James Mussatti, general manager, California State Chamber of Commerce. Both declared that the functions of Government had been overstepped in the New Deal. "We are living under an administrative absolutism which threatens the whole fabric of our system of a "free economy,'" Mussatti warned. "We have created so many independent administrative agencies in Government that they are sprawled all over Washington. They have, in effect, become the fourth branch of our Government." Other speakers included H. S. Washburn, Plainville, Conn., president American Foundrymen's Association, on "Merchandising Jobings Castings," and Pat Merrick, public welfare statistician of the State Chamber of Commerce on "Changes in the Unemployment Insurance Act and the Effects on Industry."

Otto Lundell, who until his retirement a year ago from active business was president of Michigan Tool Company, Colonial Broach Company and Detroit Tap and Tool Company, died at Fort Lauderdale, Florida, February 22, at the age of sixty years.

Steel plants of the nation expect to spend $146,000,000 for new equipment this year, an amount which exceeds the total expenditures in either of the preceding two years and brings the total outlay since 1934 above $1,000,000,000. The American Iron and Steel Institute arrived at this figure from a survey of 150 companies. Practically all the **equipment** program is **for installation in plants already in operation.** Officials of the institute said no data was available as to specific expenditures by individual companies.

An association of independent unions claiming to represent 50,000 employees of Republic Steel Corp., on March 5 **asked the Supreme Court at Washington to set aside a National Labor Relations Board order requiring disestablishment of the organization as bargaining agent for Republic workers.** The Central Council of Steel Plants, composed of unaffiliated unions at Canton, Massilon, Youngstown, Warren and Cleveland, said it **was formed after the "little steel" strikes of 1937 and is a voluntary, not company dominated, union.** The labor board found that unfair labor practices by Republic caused the widespread 1937 strikes and ordered reinstatement of about 5,000 workers. The order has been appealed to the Supreme Court by Republic. The council told the Supreme Court that Congress "did not intend to empower the board to outlaw and destroy forever an independent union of honorable standing."

Mid-West

Plans for construction of a **$500,000 plant by the Hydraulic Press Manufacturing Co., Mount Gilead, Ohio,** have been **announced by Howard F. MacMillin, president.** The plant will be located in 60 acres purchased in February on north side of Route 95 half way between Mount Gilead and Edison. It will be located about one-half mile west of the present plant. **Estimated cost** of the plant **includes new equipment to manufacture larger presses.**

Russian buyers have placed two orders for industrial equipment with American companies, it was learned in well informed quarters Feb. 14. **Clark Bros.,** subsidiary of Dresser Mfg. Co., **Bradford, Pa.,** was understood to have booked **an order for gasoline engine compressions to be used in the Russian oil fields.** This order was believed **to total about $2,000,000.** Another for a **steam turbine** and other equipment was **reported placed with Westinghouse Electric & Mfg. Co.** These orders followed recent disclosures the **Soviets** were **taking substantial quantities of American copper and other metals at**

(Continued on Page 36)

MORE STAMPINGS...

...FEWER REDRESSINGS

Long experience in automotive and other metal stamping plants has proved that Nickel cast irons are dependable, durable and economical die materials. Tough, strong, hard, exceedingly dense in structure and resistant to wear, Nickel cast iron dies give greater production with fewer redressings and interruptions of schedules. Please write for your copy of the helpful new booklet, "Nickel Steels, Nickel Cast Irons and Non-Ferrous Nickel Alloys for Modern Production Equipment."

on dies cast in NICKEL alloy irons

SHEET STAMPING—Because they are strong and hard, wear resistant yet readily machinable, Nickel-chromium cast iron dies are extensively used in forming sheet metals. Fine-grained Nickel alloyed irons take a high polish, eliminate galling and streaking of stamped parts. Plant experience proves that Nickel iron dies wear 3 to 6 times longer than plain iron dies.

PRESSING AND STRIKING—For pressing novelty coins, identification tags and discs and a wide variety of such products, Nickel-chromium cast iron dies have proved very satisfactory. Nickel cast iron dies are also used for striking and forming malleable iron castings warped during annealing or parts not easily cast in final shape. Nickel irons can be heat treated to develop high mechanical properties.

HOT PROCESSING—Resisting heat and mild shock, Nickel-chromium cast iron dies are used successfully for many drop forging and hot processing applications. In forming light steel parts; light and medium brass, bronze and Nickel silver forgings, Nickel cast iron dies offer a long useful life at low initial cost. Costs of sinking Nickel alloyed iron dies are reduced because blanks can be cast closely to shape thereby minimizing finishing. Your inquiries regarding dies and many other money-saving applications of Nickel cast irons and Nickel alloy steels are invited.

THE INTERNATIONAL NICKEL COMPANY, INC. **67 WALL STREET NEW YORK, N. Y.**

Mexican and Pacific ports for shipment via the Pacific Ocean and Trans-Siberian Railway.

The Lehigh Valley Railroad is working out an equalization work schedule to provide 12 months regular employment for its men. Albert N. Williams, president, announced the night of Feb. 13. Saying some progress already had been made, Williams pointed out in a talk at a banquet of 1,000 shop workers at Sayre, Pa., that the shop schedules are unchanged from a month ago despite a 35 per cent drop in business. He said the company aims to have all employes work a uniform schedule the year around.

F. E. Williamson, New York Central president, says the road is considering purchase of locomotives and freight cars but types and specifications have not been decided. Equipment is to replace obsolete rolling stock.

Carl Burkart, production manager of Federal Gear Inc., Cleveland, and an employee of the firm for 21 years, died March 5 after a long illness. He was 50. He is survived by his widow, a daughter, two brothers and two sisters.

New England

Both production and employment in Western Massachusetts industry is holding up well as 1940 entered its third month with indications that there will be little material change in the spring period either. Particularly in the metal trades industry are factories maintaining the volume of output which has made this winter season one of the best in many years.

Those plants supplying aircraft manufacturers such as Springfield Bronze and Aluminum, Perkins Machine and Gear and Moore Drop Forging still are getting the benefit of the large aircraft purchases which are being made both by the United States and foreign governments.

The East Springfield plant of Westinghouse is in peak production currently and expects to stay at that level for several months at least and other metal working factories that still are going strong include Chapman Valve, Indian Motorcycle, American Bosch and Van Norman.

John Oakley has been elected president of the Perkins Machine and Gear Company of West Springfield. He succeeds J. Leigh Perkins who in effect swapped offices with Mr. Oakley by becoming vice president, the position Mr. Oakley had held. The change was explained as resulting from the desire of Mr. Perkins to "take things a little easier." It also completes a reorganization of the executive management which was started at the annual meeting of stockholders several weeks ago when John J. Duggan was not a candidate for reelection as treasurer because of the pressure of other duties as president of the Chapman Valve Co. Elected to that office was Dr. Edwin C. Gilbert, who has been general manager of Perkins.

Loring F. Hosley, 48, vice president and general manager of the Indian Motorcycle Company, Springfield, for the last 10 years, died suddenly Feb. 28 in his home in Southwick. Dwight L. Moody, general purchasing agent has been promoted to general manager and elected a vice president of the company, according to E. Paul DuPont, president.

H. A. Feldbush has been elected vice-president of the Worthington Pump & Machinery Corp., it was announced Feb. 29 by H. C. Beaver, president. Feldbush will make his headquarters at Holyoke where he will be in charge of manufacture of air conditioning and refrigeration equipment. Feldbush formerly was general manager of the carbonated division in Harrison, N. J. In his new post he will continue as an active member of the Carbondale committee.

The L. S. Starrett Company of Athol reports orders at a good peak with indications of a continuance in the second quarter.

William H. Gates, production manager of Baldwin-Duckworth Division of the Chain Belt Co., has been elected to the board of directors of the company, succeeding George H. Empsall of Springfield who will continue as vice-president. Some years back the company amalgamated with the Duckworth company of Springfield and last year the merger with the Chain Belt Co. was effected. Mr. Gates, who studied at Worcester Polytechnic Institute, went to work with the company in 1920 as a factory worker from which he has risen to his present position.

Col. Horton W. Stickle retired April 1 as purchasing agent of the Florence Stove Co., Gardner, Mass., after nine years with the concern.

Foster N. Perry has been appointed general sales manager of the American Bosch Corporation, Springfield. Following his graduation from M.I.T. in 1924, Mr. Perry became associated with the Bosch. He worked at the main plant a number of years, later acted as sales manager of the New York division and more recently has been sales manager of the western division with headquarters in Chicago. A. C. Altree, who has been sales engineer at Springfield, San Francisco and Chicago, will succeed Mr. Perry as sales manager of the western division.

George M. Rudy has been elected vice president and general manager of the Norwood Engineering Company in Florence. He succeeds Howard W. Hosford who retired last year as general manager of the concern. Mr. Rudy became vice president of the Norwood Company and general manager of the paper mill equipment division in March, 1939, after an association with the company dating back to 1904. Until 1926 he was a foreman at the plant, when he became sales engineer and manager of the paper machinery division. In 1930 he was made superintendent and assistant general manager of the company. He is widely known for inventions and developments in paper finishing machinery.

A. J. Hoyt, assistant manager of the Worcester plant of the American Steel & Wire Co., has been appointed manager of operations for the Cleveland district of the company, succeeding B. H. Gedge, who has been named as assistant to the vice president in charge of operations.

Pioneering in the use of plastics in the small arms field is the J. G. Stevens Arms Co. of Chicopee Falls, a division of the Savage Arms Corp., which now is producing sporting rifles in which the stock and foregrip are made of plastic material rather than wood. The Stevens company also is working with the Indian Orchard Plastics Division of the Monsanto Chemical Co. although the plastic it now is using comes from Tennessee. Revolver grips of plastics have been in use for some time but the Stevens company was the first to eliminate the wood on rifles.

James Y. Scott, executive vice president of the Van Norman Machine Tool Company, of Springfield, was elected president and general manager of the company, March 5 at an organization meeting of the board of directors. Scott was also reelected treasurer of the company for the ensuing year. Reginald W. Porter was reelected assistant treasurer, Frederick D. Van Norman was reelected vice-president and clerk and Leo F. Hunderup was reelected assistant general manager. At the stockholders' meeting, Scott reported that the new plant addition has been completed and that the outlook for the future was "very satisfactory."

Mayor Alfred Wollacott announces the Boston & Maine Railroad wheel mounting shop at Fitchburg will close soon with employes being transferred to the Billerica shops.

Johnston Steel & Wire Co. of Worcester has taken out a permit for an addition of about 1,500 square feet to its Wise Avenue plant. The addition, which will increase manufacturing facilities, though not large, serves to call attention to the development of this company over a short period. Started about ten years ago by three brothers, sons of a noted wire-making father, who started the Worcester Wire Works, it has increased the working force every year until it now has several hundred employes locally, plus branch plants in Akron, O., and Los Angeles, Calif. Charles D. Johnson is president and general manager, Bernard A. is treasurer and George G. is secretary and assistant treasurer.

The Norton Co. of Worcester has started to install a new power plant capable of generating electricity to make possible more than a 50 per cent reduction in the amount of electricity now supplied the company by New England Power Co. The installation will be completed by July 1.

The Harcon Iron and Steel Company of Portland, Me., will begin erection of a $75,000 plant April 1 to salvage bodies of abandoned automobiles for sale as scrap. Announcement of the new corporation's plans was made by Atty. M.

(Continued on Page 68)

COSTS were cut 30%

ON THESE MISCELLANEOUS PARTS

The New Gisholts Are Doing It Every Day

● Perhaps you regard some of your costs as "standardized"—perhaps further economies are not apparent. This manufacturer thought so—until he installed this new Gisholt 1L High-Production Turret Lathe. Parts come to the machine in small quantities of only 25 and 50 at a time. Yet its faster, easier operation made it possible to cut the average machining costs 30% on 19 different items.

Probably there are similar savings to be made in your plant. Would you like to have a Gisholt engineer show you how they are possible?

★ *On work such as shown above, the ability to take multiple cuts, the rapid traverse on the cross slide and the cross-feeding hexagon turret are important time-saving features of the Gisholt machine. Furthermore, the operator finds it easy to feed to exact dimensions with the large micrometer dials and automatic stops provided on this machine.*

• • •

Gisholt High-Production Turret Lathes are described in this new Bulletin. May we send your copy?

"YOUR SMARTEST INVESTMENT TODAY—BETTER MACHINE TOOLS"

GISHOLT

GISHOLT MACHINE COMPANY

1229 EAST WASHINGTON AVENUE, MADISON, WISCONSIN, U.S.A.

TURRET LATHES · AUTOMATIC LATHES · TOOL GRINDERS · BALANCING MACHINES

A. S. T. E. DOINGS . . . *By Geo. J. Keller*

THE large attendance at **Los Angeles** Chapter's meeting held at Scully's Cafe February 22 heralded a departure in the meeting routine. Heretofore the meetings following the dinner have been turned over to outside speakers. At this meeting, however, after listening to a lecture with slides by Mr. Walter P. Lotz of the Landis Tool Co., the meeting was taken in hand by Louis Bieler of Lockheed Aircraft Co., and H. F. Lenz of the National Postal Meter Co. The latter speaker with chalk and samples described some of the various types of "magazines" vise jaws developed by this company. Mr. Bieler exhibited an elaborate chamfering fixture built for his concern, as an example of wrong design and a caution of what not to do. The enthusiasm with which this departure in meeting routine was received gave promise of making all future meetings, symposiums of local developments in Tool Engineering. By the way Los Angeles held their first Annual dance at Sunset Masonic Temple, March 16th.

Mr. Judkins, of Firth Sterling Steel Co. gave an interesting lecture on Carbide Tools to about eighty members and guests of **St. Louis** Chapter on March 14. The big event of the evening was the introduction of new officers and relinquishing of the chair by E. A. Doogan to D. D. Burnside. Doogan has had it for two years, has done a swell job and he could almost have had a third term. The Chairman D. D. Burnside and his co-officers Sinning, Miller and Reheis are vigorous boosters for the Society and should do as good a job as their predecessors. Both Doogan and Burnside talked a lot about the New York Convention, in fact so much that every one resolved to attend the next one. Incidentally it was Doogan's Birthday so many reached home quite late.

York Chapter had a real turnout for the March 12th meeting at the West York Inn. The speaker was Chairman G. L. Reed who talked on "Press Tools for Cutting and Shaping Sheet Steel." His talk accompanied with moving pictures and samples of difficult stampings was a highlight for the Chapter. A lively discussion followed the talk. The annual meeting at New York was discussed and officers for the ensuing year were elected.

Dayton Chapter met at the Gibbons Hotel on Monday, March 11th, for the monthly dinner meeting. Chairman Johnston gave a report on the annual meeting in New York. Whitey Poock and Bob Ziegler, who also attended, gave their impressions on the technical sessions. The report that Cincinnati Chapter was awarded the semi-annual fall meeting was heartily received by the local chapter. The technical session was under the auspices of the Heald Machine Co. with Mr. F. F. Ellis, Consulting Engineer as the principal speaker. A long discussion followed. Emerson Carmony is now with Cincinnati Milling Machine Co. Dayton's loss is Cincinnati's gain.

Henry Ruehl presided at the dinner while 125 members and guests of **Rockford** Chapter dined at the Faust Hotel on March 14th. When the dinner was over the speakers for the evening were introduced. Immediately following this colored travelogue movies were shown of a trip through New Brunswick by Francis and Frank Colehour. Stuart C. Lawson of Ampco Metals Inc. adressed the group at 9:00 P.M. on the subject of "Modern Bronzes" and was followed by G. H. Sanborn speaking on the subject "New Developments in Involute Gearing." All features of the gathering were "Tops" and another meeting went down on the records as a grand success.

About 75 turned out for the March 6th meeting of **Tri-City** Chapter at the LeClaire Hotel, Moline, Ill. Chairman Reller attended the meeting in New York so J. B. Morganthall, Chairman-elect got in a little practice. W. H. Oldacre gave an interesting talk on "Cutting Oils" and his company, the D. A. Stuart Co., had a display. The new officers take command in April.

About 60 members and guests attended the March 14th dinner meeting of **Buffalo** Chapter. R. W. Pearson, Control Engineer of Westinghouse Electric and Mfg. Co. gave an illustrated lecture on Electronic Controls in Modern Resistance Welding. An interesting discussion followed. Chairman Winter reported on the annual meeting.

Milwaukee and Racine Chapters held a joint meeting at the Pfister Hotel on Wednesday, March 13th. This meeting was in participation with the Wisconsin Engineering Conference, which was a convention of technical, professional and social sessions for all engineers. The convention was held from March 13th to March 15th and many A.S.T.E. members attended other sessions of the engineering conference in addition to their own.

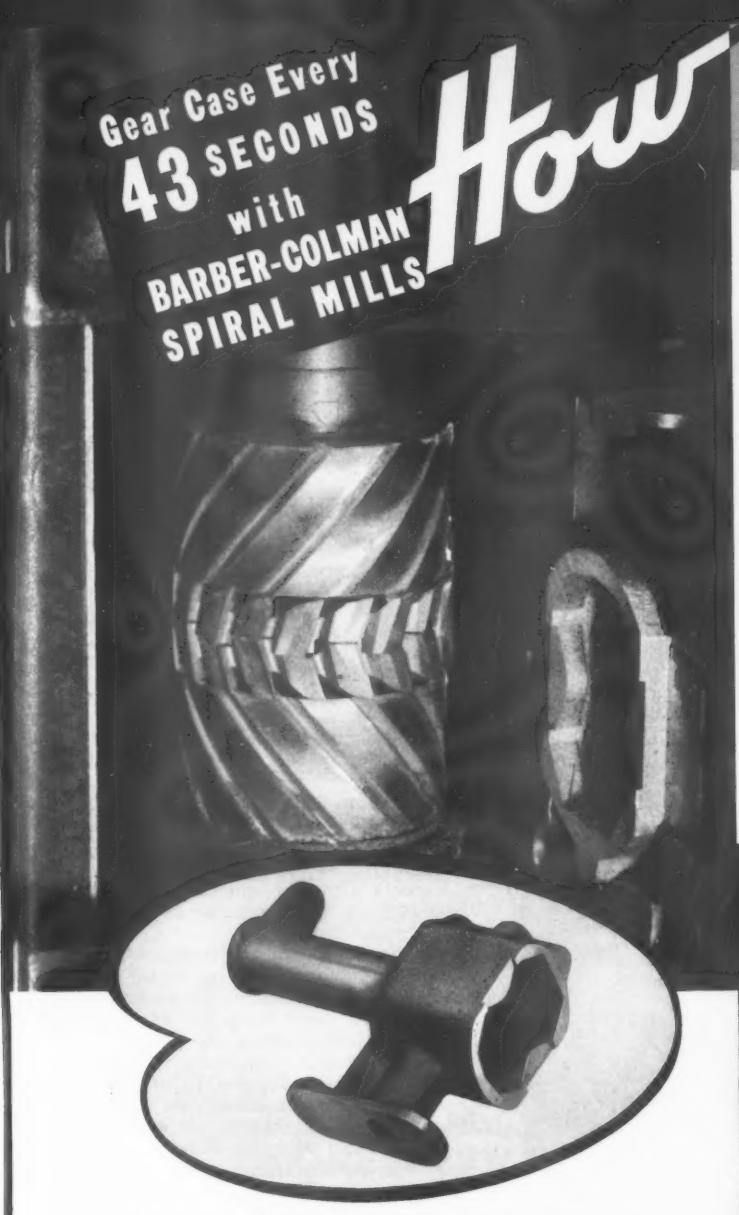
At the meeting on Wednesday there was a threefold entertainment. "The Miracle of Light" by A. A. Engelhard of the Wisconsin Electric Power Co., "The Function of Tool Engineers in Industry" and the moving picture "Steel —Man's Servant and Men Make Steel" by Carnegie Illinois Steel Corporation were all enlightening and entertaining. An interesting time was had by all who attended and we hope that our organization will be invited to participate again next year.

Cincinnati Chapter is fortunate in getting the next Semi-Annual Meeting of the A.S.T.E. in October of this year. The chapter, there, is already laying its plans to act as host, when it is expected a large turn-out will call for concerted effort to provide adequate hotel accommodations, meeting rooms, etc.

Springfield, Massachusetts is latest city to have chartered a chapter of the A.S.T.E. On February 26th more than seventy-five Tool Engineers in the Springfield Industrial area got the new chapter off to a flying start. Before a total attendance of 150, A. H. d'Arcambal, now President of A.S.T.E., J. R. Weaver, retiring President, Ford R. Lamb, Executive-Secretary and Frank W. Curtis, chairman of the new chapter (reading in same order from left to right) gave talks on the growth, accomplishments and influence of the Society as well as the growing importance of the profession of Tool Engineering.

How TO GET SPEED AND ACCURACY

Gear Case Every 43 SECONDS with BARBER-COLMAN SPIRAL MILLS

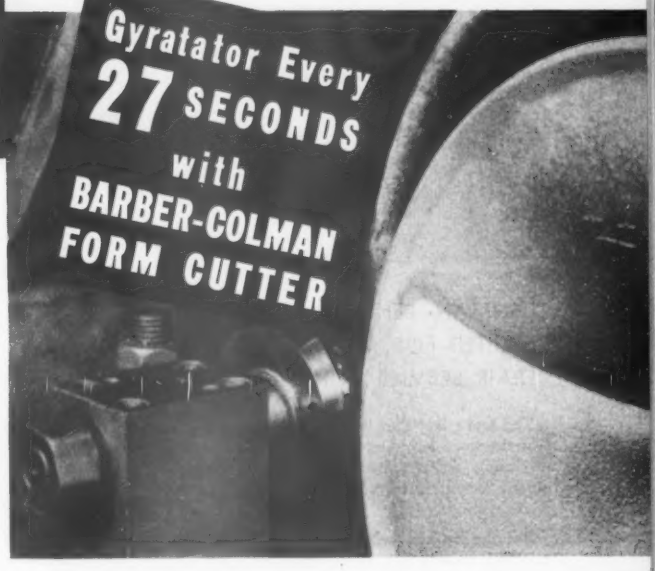


Here's how a washing machine manufacturer get low-cost speed and accuracy on widely different jobs

Operation No. 1, pictured at left, employs Barber Colman Spiral Mills for slabbing and slotting cas iron gear housings; nets 85 pieces an hour, 800 pe grind. On job No. 2, below, a Barber-Colma Form Cutter shapes the rim of a Lynite Gyratator c 707 surface feet a minute; turns more than 133 piece hourly; averages 200 pieces per grind; cutter life 32,000 pieces.

That's typical of results you get when using Barber Colman service on mills and cutters; whether standard made-to-order, or designed for the job by Barber Colman. Upon request, a Barber-Colman enginee will cooperate in developing profitable application for your shop . . . No obligation, just write.

Gyratator Every 27 SECONDS with BARBER-COLMAN FORM CUTTER



PERFORMANCE DATA NO. 1

Name of Part — Wringer gear housing; illustrated above.

Material — Gray cast iron.

Operation — Milling end surface with slot; and top surface.

End Stock Removed — ½" x 3⅛" x 3⅞", cored in center; including slot 1.375"—1.377" wide.

Holding — Indexing fixture holds 4 pieces; mill two while changing two.

Cutters — Two Barber-Colman Spiral Mills, with B-C Interlocking Side Mill between them on vertical arbor, mill the end surface. An inserted tooth cutter mills top at the same time.

Surface Speed — 150 feet a minute.

Feed — 12" a minute.

Production — 85 pieces an hour; 680 in 8-hour day.

Pieces per Grind — 800.

PERFORMANCE DATA NO. 2

Name of Part — Tub Gyratator.

Material — Cast Lynite.

Operation — Form turning diameter and rim, holding ±.010" on 13½" outside diameter.

Holding — In air chuck with draw bar.

Cutter — Barber-Colman Form Cutter.

Speed — 200 r. p. m.; 707 surface feet a minute.

Feed — Hand feed to positive stop.

Production — 133¾ an hour; 1070 in an 8-hour day.

Pieces per Grind — 200; tool life approximately 32,000 pieces, or 30 days' service.

BARBER B-C COLMAN

PRODUCTS

MILLING CUTTERS, HOBS, HOBBING MACHINES, HOB SHARPENING MACHINES, REAMERS, REAMER SHARPENING MACHINES, SPECIAL TOOLS

Pocket size, 263-page Barber-Colman Catalog K includes 75 pages of valuable information on mills, cutters; contains lots of handy shop data. Mailed free on request.

Barber-Colman Company

General Offices and Plant 213 Loomis St. Rockford, Illinois, U. S. A.

into the regular productive system lies indefinitely far ahead. We have been creating new jobs not much faster than additional workers are coming of age and joining the potential labor force."

If this be true, we certainly can look forward to a dark future! But perhaps the Technocrats and their sympathizers confuse the issue by mis-stating it. We, as Tool Engineers, do not admit that machines create unemployment. However, we do admit that improved manufacturing facilities reduce the labor content of the product. This is an entirely different thing. It is the principal contributing factor to our present high standard of living.

Let's take a little closer look at our standard of living. Money, as measured in dollars and cents, means nothing. The true measure of money, in or out of the pay envelope, is what it will buy. Based on a study of 25 industries, the average worker of 1914 earned a weekly wage of a little more than $12.50 for about 57 hours of work. Using the 1923 level as 100 units, he could buy about 78 units of commodities with his pay check. Today, in the same 25 industries, the average worker makes a little over $27—more than twice as much as in 1914—for 37 hours of work, which represents 35 per cent less time. With this fattened pay check he can buy 115 units of commodities, as compared with the 78 of 1914.

Perhaps you say to yourself: "Why, if the worker of today earns more than twice as many dollars as the worker of 35 years ago, can he not purchase twice as much with them?" Well, at least a part of the answer, as I see it, is taxation. The commodity of today is produced at a much lower cost than that of yesterday, but government imposes processing taxes and sales taxes which the consumer must pay. Thus while government pats the worker on the back with one hand, it picks pennies from his pocket with the other, and it's all done so unobstrusively that the worker is unaware of it.

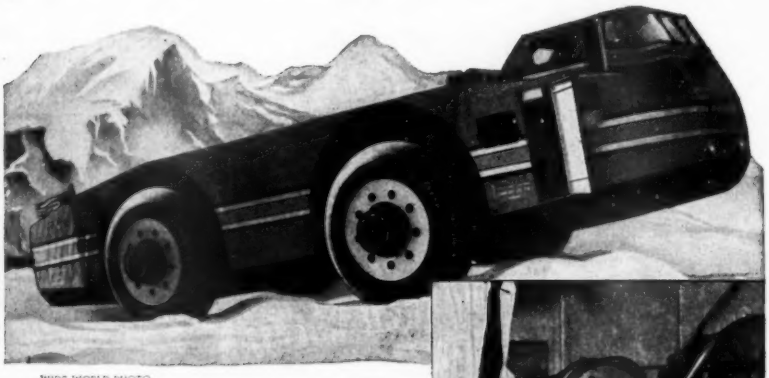
Another of the fallacies of the Technocratic point of view is the assumption that business is interested in keeping down the quality of a product to broaden the replacement market, and at the same time making more profit from a cheapened product. Business does not determine how good or how bad a product shall be. Neither does business determine what products to manufacture. All these things are determined by the public—the consumers. It is true that the quality of a commodity must be commensurate with its selling price, and the selling price must be such that it will create a market and can be purchased by a sufficient number of people to justify the cost.

I mentioned previously that improved production methods and machines reduce the labor content of the product. But we have other costs that burden the cost of manufacture. Again—taxation—coupled with such things as "interferences with production." To broaden or retain existing markets, we must maintain or reduce selling prices. But when taxes and other expenses are imposed on manufacturing cost, this increase must be offset by a reduction in labor content. Therefore, labor pays the bill again. Regardless of whether labor content is reduced or maintained, the amount of the commodity consumed determines the total amount of labor needed. If the price is high, distribution falls off, and less labor is needed. This policy of producing things more and more efficiently to lower manufacturing cost requires an increasing amount of skilled labor, because the problems of industry are becoming more difficult.

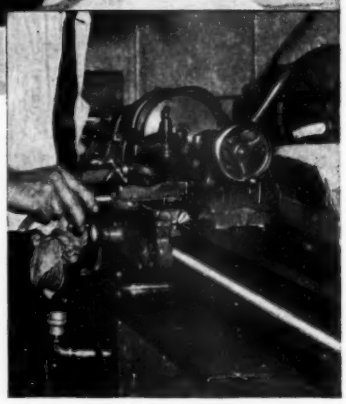
Today, we find employment agents scouring the country for skilled workers —and they aren't having much success. Our economic know-it-alls try to tell us that we are in about the same position as the crew of a vessel sailing off the coast of South America. The ship's water supply had given out days ago. Several of the crew had died of thirst, and the others were panicky. Suddenly a ship was sighted, and the thirsty crew sent up the signal "Water—give us water." The reply came: "Cast your buckets

(Continued on Page 42)

CUSHMAN PRECISION
follows the **SNOW CRUISER**



WIDE WORLD PHOTO



CUSHMAN BENCH LATHE CHUCKS SELECTED FOR MAINTENANCE AND REPAIR SERVICE IN THE *Antarctic*

The mere fact that two Cushman Bench Lathe Chucks were supplied for the small lathe in the workshop aboard the Snow Cruiser probably means very little to you who operate a busy production shop.

But the reason why Cushman Chucks were selected, is very important. Every smallest detail of equipment taken by Commander Byrd's expedition was naturally the BEST and MOST RELIABLE that good judgment could select. And the good judgment of engineers the world over constantly favors Cushman Chucks . . . for PRECISION . . . for COMPLETE LINES . . . for competent engineering service.

Let us help you NOW to get the most out of YOUR production equipment.

•

THE CUSHMAN CHUCK COMPANY
HARTFORD, CONNECTICUT

CUSHMAN CHUCKS
A WORLD STANDARD for PRECISION

Surprisingly TOUGH...

is the Cast Cutting Alloy

*REXALLOY

Intermittent Cutting!

Machine: Engine Lathe
Material: Hard Sandy Bronze entire surface drilled with countersunk 3/8" lubrication holes
Operation: Turning and Facing Side Rod Bushings

Travel: 11"
Speed: 150 SFM
Feed: 5/64"
Size Tool: 1/2" Sq.
Diameter: 15"

"PHENOMENAL" was the comment of a prominent metallurgist after witnessing a customer's production test with REXALLOY cutting a Heat Treated Alloy over 400 Brinell at 20 times the best previous speed . . . even stalling a most modern machine tool. The General Superintendent who hadn't smiled in 15 years witnessed the demonstration, grinning from ear to ear and said, "You've certainly got something there . . . when do we get more tools."

☆ ☆

You'll discover REXALLOY'S extra toughness makes it adaptable for heavy duty applications at higher speeds than possible with Tungsten Carbides. For instance, here's a REXALLOY bit turning and facing a hard, sandy bronze side rod bushing, the entire surface of which is drilled with countersunk 3/8" lubrication holes. Despite the intermittent nature of the cut and the highly abrasive metal, REXALLOY does the complete job without any stop for regrinds . . . and without breakage!

REXALLOY . . . intermediate in properties and price between High Speed Steels and Tungsten Carbides . . . is sweeping the country. You should know all the facts about this remarkable cast cutting alloy.

Call Crucible's nearby Branch Office and a Crucible Man will be sent promptly to demonstrate REXALLOY on your machines. If you prefer write for latest REXALLOY Bulletin 51 with details and case-histories of REXALLOY performance.

*Reg. U.S. Pat. Off.

CRUCIBLE STEEL COMPANY of America

Specialty Steelmaker to INDUSTRY

CHRYSLER BUILDING • 405 LEXINGTON AVENUE • NEW YORK CITY
BRANCHES WAREHOUSES AND DISTRIBUTORS IN PRINCIPAL CITIES

MAKERS OF HIGH SPEED, TOOL, STAINLESS, ALLOY, PRODUCTION AND SPECIAL PURPOSE STEELS

OUR SOCIETY AND INDUSTRY

(Continued from Page 40)

where you are." Again the frantic crew hoisted the signal. "Water, water—we are famished." And again the answer came: "Cast your buckets where you are." At last, in desperation, the crew cast a bucket into the sea and drew it up, filled with sparkling, fresh water from the mouth of the Amazon River!

Now, we have a sea of unemployed—about 9 million of them—and theoretically we should be able to "cast our buckets where we are." But you and I know that an astonishing majority of these 9 million are ill-fitted physically, mentally, or by training and education, to fill the urgent needs of industry.

Everybody agrees that this is a cock-eyed situation, but we are pretty much in the same position as the frog that fell in the rain barrel—we'd gladly go some place, if we only knew which way to jump. I think I can see one jump ahead in the right direction. If you had in your warehouses a huge stock of products which nobody would buy, but which everybody needs, would you condemn the buying public as foolish? No, indeed. The only logical conclusion you could reach is that there must be something wrong with the product; and you would have to change your product to suit the taste or pocketbook of consumers. The labor situation is somewhat analogous. Each year our educational institutions grind out graduates by the hundreds of thousands, and, unfortunately, a good share of them go into the labor warehouse, along with the other 9 million or so. Thus far industry has been maligned by educators and legislators alike because it refuses to "buy" these surplus labor commodities, but few have wondered whether perhaps there might not be something fundamentally wrong with an educational system which continues to turn out workers that are unmarketable, even though help is urgently needed.

I understand that a large part of our horde of unemployed—about 4 million, in fact—are young people—fellows who have gone through school with high ambitions, eager to work at the kinds of jobs for which they have trained themselves, and yet are repeatedly turned away from our employment offices. Yet, in foreign countries the dictators go out of their way to impress upon their youth how necessary they are to their country.

The words of one of our foremost newspaper commentators summarize my own thoughts in so much better language than I command, that I take the privilege of quoting them to you at some length: (I quote)

"I remember that I first began seriously to fear the rise of Hitler when I heard him, in 1930 or 1931, address a mass meeting of such young people. He told them quite simply. 'The men who lead the present system say they have no place for you. They say they do not need you. Well, I need you. I need to make over this country. I do not promise you comfort, or security, or ease. I promise you a part in the remaking of a nation. I promise you comradeship and fidelity. And as long as I live, you shall belong to me and I shall belong to you!' And those thousands of youths rose and screamed their cheers and enlisted in his ranks. For he had uttered the most moving words that youthful ears can hear; 'I need you.'

"A society that does not need its youth will be destroyed by that youth. They will never forgive the theft of their manhood—of their right to become men. You cannot buy them off with doles, or artificially prolong their school days for the sake of keeping them off the labor market, or shunt them off indefinitely into the CCC.

"The unemployment of youth has resulted in a disillusionment among them that should give this nation pause, if it hopes to avoid very serious and painful social disturbances.

"There is no superficial answer to the problem. I am personally convinced that we need seriously to review our whole system of primary and secondary education, raising the question whether it is really producing the type of human being best adapted to the realities of this century.

"I have the conviction that we are training too many of our young people

(Continued on Page 62)

1939 · MODERN PLASTICS COMPETITION · 1939
CERTIFICATE OF AWARD
GEORGE GORTON MACHINE CO.
FOR PARTICIPATING IN ONE OR MORE OF THE SIXTY-TWO OUTSTANDING PLASTIC APPLICATIONS OF NINETEEN HUNDRED THIRTY-NINE SUBMITTED IN THIS NATIONAL ANNUAL COMPETITION
m
p

Two New Awards

Two new certificates of award in the 1939 Modern Plastics competition have been presented to the George Gorton Machine Company for the part its machines contributed to the production of outstanding plastic applications. Fifteen leaders in this contest, receiving more than thirty-five awards, are owners and users of Gorton die and mold equipment.

Let us help you cut production costs and production time; tell us your problems.

GORTON

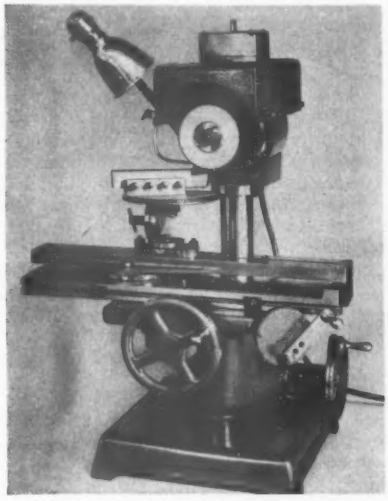
FOR COMPLETE INFORMATION, WRITE TODAY!

GEORGE GORTON MACHINE CO.
1111 13TH STREET, RACINE, WISCONSIN, U. S. A.

Mention "The Tool Engineer" to advertisers

New Grinder Quickly Grinds Chip Breakers In Carboloy Steel-Cutting Tools

A chip breaker grinder especially adapted to the safe, rapid grinding of chip breakers in steel-cutting cemented carbide tools is announced by Carboloy Company. The machine is equipped with a simple Universal fixture that can be quickly set to produce a



chip breaker exactly to specifications. Chart furnished with each grinder gives exact setting for each of the three protractors on the universal fixture. By means of this, settings can be made to meet any given tool specifications, and exact duplication at any time is possible, a particularly desirable feature for regrinding Carboloy steel cutting tools. Write for leaflet GT-121 containing complete details.

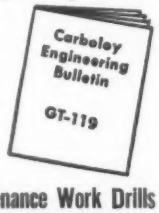
New Booklet Shows How Warner & Swasey Applied Carboloy Tools To 1500 Operations

In view of the noticeable trend toward the use of carbide tools broadly throughout the shop rather than as a special tool for difficult jobs, a new booklet recently issued by Carboloy Company is of unusual interest.

This 12-page booklet tells in detail how Warner & Swasey Company applied cemented carbide tools on approximately 1500 steel and cast iron operations, resulting in a 43% average increase in machine capacity on those jobs. Blueprints of tools used, time studies, and illustrations of typical applications are included. Send for booklet GT-403.

New Engineering Bulletin Gives Recommendations For Machining Ampco Metal

This new Carboloy Engineering Bulletin lists specific speeds and feeds for rough, semi-finish and finish machining of Ampco Metals with Carboloy cemented carbides. Bulletin also covers tool design, coolants, etc. Send for Bulletin GT-119.



Carboloy Drill For Maintenance Work Drills Holes In Concrete, etc., 75% Faster

Tip your maintenance man off to the Carboloy Masonry Drill. Drills concrete, tile, brick, slate, porcelain, etc., 75% faster than old methods. Send him leaflet GT-103.

. . . IT'S TOMORROW

Time never quite catches up with the men in our Research Laboratories. They deal largely with the possibilities of tomorrow. Their job is to obsolete the present, to constantly seek *better* methods, *better* equipment, *better* ways to make *better* Carboloy.

Often of far-reaching importance are the things they do. They impregnated Carboloy with diamond particles . . . and now those who dress grinding wheels have a diamond dresser that requires no resetting—no expensive stones . . . they applied this same material to the mining field—and it bids fair to revolutionize core drilling practice . . . they took microscopic particles of carbide—100 trillion to a pound of Carboloy—and *"split them in two"* to produce grades of Carboloy having an order of performance and life never before attained. . . . *NOW* they're perfecting a special extrusion process that turns out Carboloy *by the yard*—replaces 300-ton hydraulic presses. Things of this order they have done to mould "visions" into realities.

The "Tomorrows" of these men have made many things possible *today*. Carboloy is no longer just a cutting tool or a wire drawing die. It plays a part not only in *making* products but also has become an *actual part of* many products and machines. As a wear-resistant part, Carboloy is found in oil well pumps, spray guns, bread slicing machines, hydraulic equipment, business machines, refrigerating machines, saw sharpeners, machine tools, communication equipment, fish rods, etc. It helps to make such things as rayon, baby food, tomato juice, carbon resistors and coated welding rods.

Carboloy uses exceed the boundaries of your machine shop or wire mill. Carboloy is the Metal of Tomorrow with a thousand and one uses Today!

CARBOLOY COMPANY, INC., 11145 E. 8-Mile Road, DETROIT, MICHIGAN

CHICAGO • CLEVELAND • NEWARK • PITTSBURGH • PHILADELPHIA • WORCESTER, MASS.

CARBOLOY

REG. U.S. PAT. OFF.

TUNGSTEN CARBIDE—TANTALUM CARBIDE—TITANIUM CARBIDE

FOR CUTTING, DRAWING, SHAPING, EXTRUDING METALS AND NON-METALLICS
★ FOR REDUCING WEAR ON EQUIPMENT OR PRODUCTS YOU USE OR MAKE ★

Handy Andy Says →

ANOTHER Annual meeting is history, and the A.S.T.E. goes rolling along to greater things. We have a good staff of officers for '40, supported by well seasoned timber and headed by a man with a reputation for vision and accomplishment. Congratulations, d'Arcl—or should I congratulate the A.S.T.E. on its choice of Prex. Well, both then. Six months hence, Cincinnati is to be host for the Semi-Annual, then, next March, Detroit and a bigger and better Machine and Tool Show. Time flies when there's action ahead, eh?

▲ ▲ ▲

One of the things I have earnestly wished—and the idea seems so utterly sensible—is a federation of engineering societies in which (in view of its progressive spirit) the A.S.T.E. should take the initiative. This does not imply a composite Engineering Society, but a pooling of moral and intellectual resources, with each group retaining its individuality, like the various states of the Union. It is quite evident, by now, that the engineers of the world are an unselfish and constructive body. And honest! United, we can be a tremendous force for construction, not as just another minority agitating for selfish ends, but as a body of intelligent men known for analytical reasoning and with a name for getting things done. We'll give that a thought, eh?

▲ ▲ ▲

THERE came to hand a booklet, recently, issued by Brown & Sharpe Mfg. Co., listing some eight hundred odd of B. & S. apprentice graduates. With quickening pulses and eager anticipation, I turned the pages, seeking names of old friends and acquaintances whom I haven't seen during many long moons. And sure enough, they were there!—among them the son of our first landlord when, with my First Lady, I embarked on the matrimonial sea. He is living at the same old place, but whether bach or benedict I don't know. Anyway, he was a fine youngster and a fine mechanic, is now chief inspector at Taft-Peirce. Greetings, Billy O., if you happen to read this.

▲ ▲ ▲

Taking a plant tour through the Carboloy Company a while back, was a pleasure I had when Detroit Chapter had its meeting there. Despite storm and icy roads (which sent Johnny Nelson into a ditch—before the meeting) the dining room was jammed, every seat taken. While Carboloy is something comparatively new on the industrial horizon, it has just about revolutionized metal cutting, precision gaging, wire drawing and so on. It is just one example of the pioneering that is done by industry to create new things—and, incidentally, to spread employment. Carboloy has a fine plant, as modern as tomorrow (it's really built for tomorrow) and the tour was educational and inspiring.

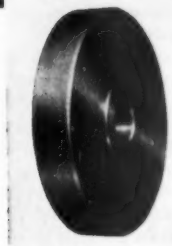
▲ ▲ ▲

Had the pleasure of meeting W. G. Robbins, capable Carboloy Prex., through Midland Wks. Mgr. Einar Almdale. The two men are fishing cronies, and both should wear well in camp, being that kind of men. You know, I've given many a deserved boost in this column, to advertisers as well as individual members, but somehow, I have never given more than passing mention to Midland Steel. Not that I haven't wanted to (I have mentioned past employers in the friendliest terms) but there just haven't been connecting incidents. Now, rounding out five years with Midland, a tribute to the men I work with—some of them A.S.T.E. members—may be in order.

What I like about Midland is its democratic spirit and fine camaraderie, a friendliness and a team work that begets results. There are no "big shots" at Midland, as that term is usually applied. Rather, practically every major executive has worked up from the ranks, or, if a college man, has donned overalls and learned the game from the ground up. The result is a splendid esprit de

(Continued on Page 46)

Automatic Stub Lathe
Improves Gear-Blank Production



Turns 17 Types, 850 Sizes
Uses Tungsten Carbide
Holds Close Limits

The Sundstrand Automatic Stub Lathe shown above runs continually on finish-turning gear blanks, handling 17 types and 850 sizes. It uses tungsten carbide tools effectively; turns diameters, faces both sides and chamfers, all in one operation. Maximum production is secured, limits on diameters and run-out are held within .001". Automatic cycle includes rapid approach, feed, dwell, tool-relief, quick return, and stop. Operator changes work-pieces on arbors while machining is in progress. The Automatic Stub Lathe is so easily set up and changed over that small lots of about 20 pieces each can be finished economically, and costs are cut proportionately on larger quantities.

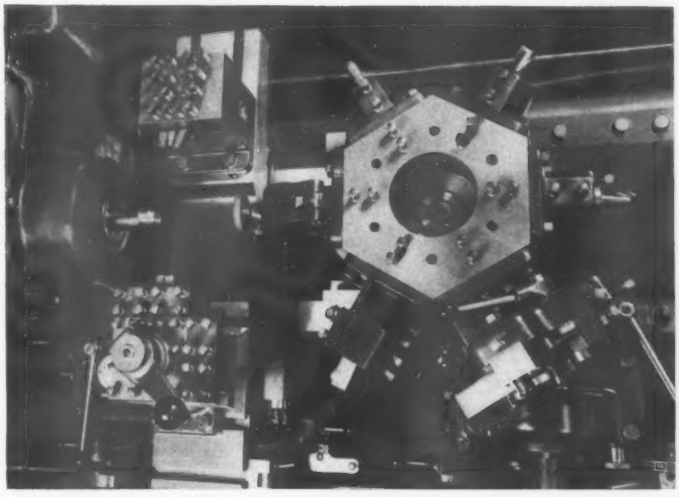
Compared to methods formerly used, this Automatic Stub Lathe increases production, holds closer limits, improves finish, cuts costs, conserves capital, saves labor and floor space. Other installations handle more complicated operations with equal ease, effect similar savings on a vast variety of work pieces. Look into the advantages of Automatic Stub Lathes for your turning.

Get Data and Estimates
Bulletin illustrated contains complete information on features, advantages, cycles, and specifications. Write for your copy, *today*. Ask for Bulletin 391. For reliable estimates on manufacturing turning operations, send drawings and data to our Engineered Production Department.

Sundstrand Machine Tool Co.
2532 Eleventh Street, Rockford, Illinois

RIGIDMILS-STUB LATHES
Tool Grinders - Drilling & Centering Machines
Hydraulic Operating Equipment - Special Machinery

Profits on small lots FROM BAR STOCK



Miscellaneous Aircraft Parts from Bar Stock are manufactured economically *and* accurately *with Jones & Lamson Universal Turret Lathes*

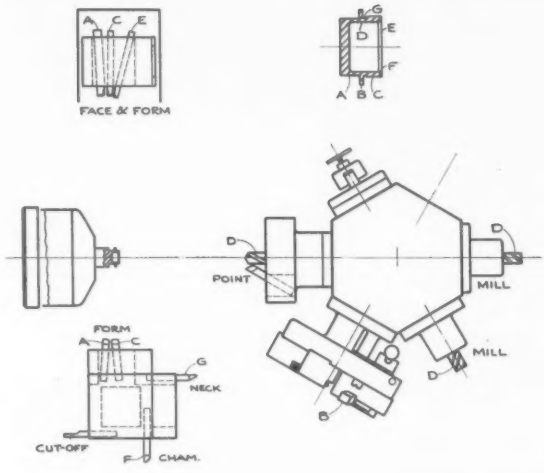
CONTINUOUS Profitable Production from bar stock, of small lots of a variety of aircraft parts, is maintained with Jones & Lamson Universal Turret Lathes.

Ease and simplicity of operation and rigidity of construction combine to produce these parts with *minimum fatigue to the operator, maximum production for the manufacturer, and satisfaction to the customer.*

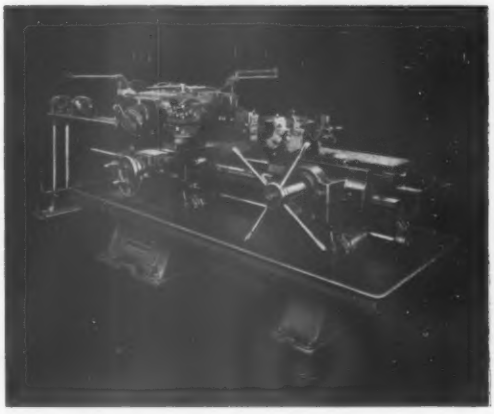
Reduced Labor-Cost, Increased Production and Customer Satisfaction are the components of real Profit. An investment in Jones & Lamson Universal Turret Lathes will pay these dividends now, and for years to come.

Our Engineers are ready to study your problems and to demonstrate that a Jones & Lamson Universal Turret Lathe is an investment that will pay for itself.

New Catalogs are now ready and will be mailed to you upon request.



Economy of Production is exemplified in this typical set-up. Standard multiple tool blocks on the square turret and a multiple tool block on the rear of the cross-slide provide for effective multiple tooling with inexpensive H. S. S. tools, eliminating the cost of expensive form tools on small lots of work. The *bridge type* carriage securely mounted on the hardened and ground steel bed ways gives more than adequate support insuring a finish, on even heavy forming cuts, that will meet the most exacting demand.



JONES & LAMSON MACHINE COMPANY

SPRINGFIELD, VERMONT, U. S. A.

MANUFACTURERS OF: SADDLE & RAM TYPE UNIVERSAL TURRET LATHES . . . FAY AUTOMATIC LATHES . . . AUTOMATIC DOUBLE-END MILLING & CENTERING MACHINES . . . AUTOMATIC THREAD GRINDING MACHINES . . . COMPARATORS . . . TANGENT AND RADIAL, STATIONARY AND REVOLVING DIES AND CHASERS

HANDY ANDY SAYS—

(Continued from Page 44)

corps throughout the organization and a very manifest confidence in the management. It may be of interest, here, that where management in many industries meets resistance to cost saving equipment, Midland men are not only receptive to improvement but are quick to suggest ideas that improve production and quality. And that is the true test of team work.

▲ ▲ ▲

As this is written, Finland bows to the inevitable; a small nation, fighting practically alone against overwhelming odds just couldn't hold out forever. It is said that the war cost the Finns some $500,000,000 in direct money, not to mention destruction of property and the loss of tens of thousands of splendid men. But written off against this loss is a name for valor and fortitude that will endure as long as humans can read and write; the Finns epitomize everything that stands for love of home, unswerving devotion, impeccable character and honesty. Now, they start reconstruction with the same energy that they manifested when resisting invasion; on ruin and ashes they will build a newer and a better civilization. May Providence now grant them long years of peace.

▲ ▲ ▲

The end of all war is peace and while we cannot predict the outcome of the sit-down war along the Westwall—whether "hell'll bust loose" some spring or a truce be declared—the inevitable end is peace. And, be it hoped, a "face-saving" peace for all concerned, so that the d—d fools that start wars, coming to realize the futility of destruction, will think twice before starting another. But, truce spells the zero hour for American manufacturers who have put all their eggs into the war basket. Such are destined to find themselves loaded up with stale eggs and no market. Fortunate indeed are those who have been far-sighted enough to plan for the inevitable collapse of the war boom, such as it's been.

▲ ▲ ▲

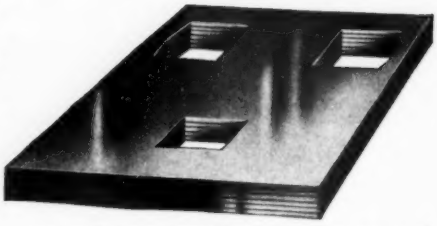
Among the truly outstanding ads of the year, in my estimation, is the one by Monarch Machine Tool Company in February Tool Engineer, "When the Armistice is Signed . . . and the flame and crash of battle are replaced by the tolling of bells . . . the roar of happy crowds . . . the question 'What of tomorrow?' will occupy men's minds. Once more, men will plan to adopt machines . . . whose use improves social and economic conditions by raising the standards of living".

No picture of a machine, but of a bell tolling a paean of peace and joy, no plug for Monarch Lathes, but a message of vital import to America. "What of tomorrow?" Tomorrow (meaning the end of the war) may be here before this reaches the reader, even before we go to press. Events move fast in this day of "blitzkrieg". And when it comes, may it find American industry prepared to turn its machinery to construction, to the further improvement of American standards of living. My personal congratulations to Monarch; theirs was not an ad so much as a living editorial on things-as-they-ought-to-be.

Yours for progress,
Handy Andy.

85 MINUTES' WORK IN 5

DeVilbiss Company of Toledo formerly jig sawed these Perfume Racks separately from C. R. Brass, each rack requiring 1½ hours. On the DoAll, they now stack 6 or more pieces, solder corners to hold them firm and saw them at one time, saving 1 hour and 24 minutes on each rack.



STARTLING RESULTS

Contour Sawing, the new DoAll process of machining, is recognized as the fastest precision method of removing metal; cuts out internal and external shapes from any metal up to 10" thick.

Does work of 3 machines. DoAll is a moderately priced, rugged, precision machine tool that replaces shaping, milling and lathe work on a large variety of jobs with enormous savings.

Used in large and small plants in 30 countries by such firms as General Instrument, Lincoln Engineering, Picatinny Arsenal, Baldwin Locomotive, Ford, General Electric, Ace Tool & Die, Penn Electric Switch, Canadian National Railways, Remington Rand, etc.

DO-ALL Contour Machines
BAND SAWING
BAND FILING
BAND POLISHING

Let a factory trained man bring a DoAll to your plant and show you what it does, what it saves on your own work.

FREE—New Handbook on Contour Machining—158 pages of valuable metal working helps.

CONTINENTAL MACHINES, INC.
1304 S. Washington Ave.,
Minneapolis, Minn.

TE-4

☐ Send data on the DoAll.
☐ Send Free Handbook.

Name .....

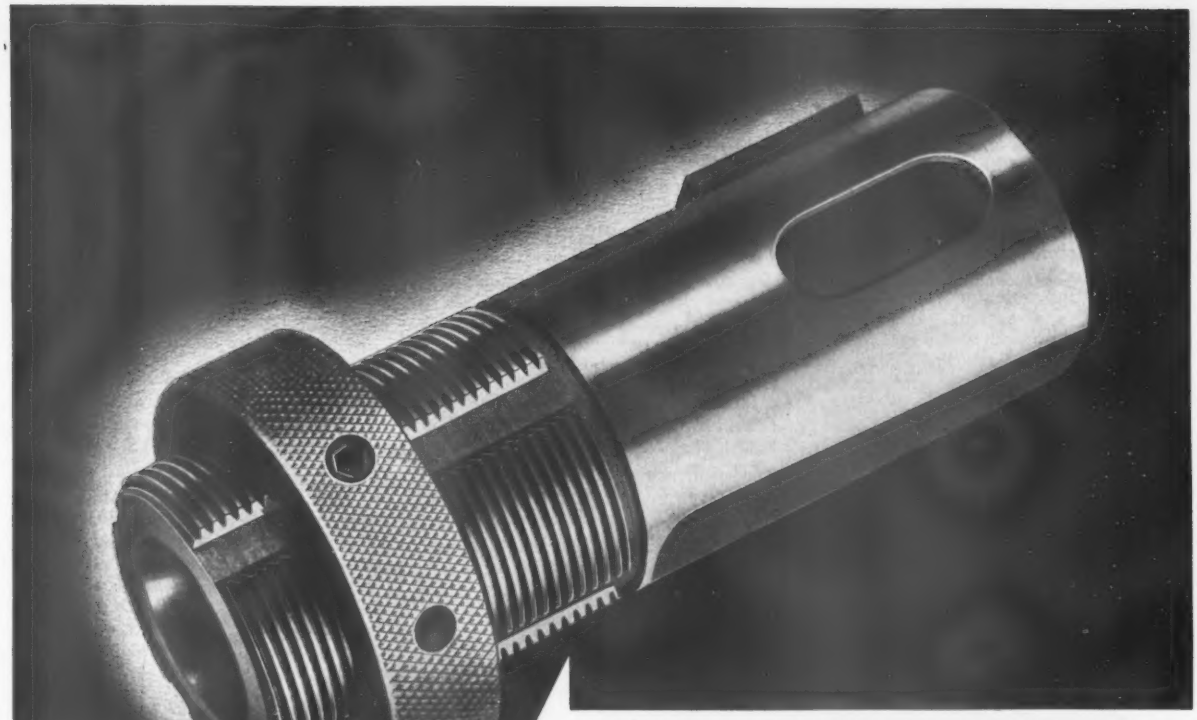
Address .....

ANNUAL MEETING—SUCCESSFUL

(Continued from Page 9)

technical sessions which embraced the all important subjects of "Tool Engineering Education", "Screw Machine Tooling", "The Economics of Tooling", "Punches and Dies", Precision Small Gears", "Tooling for Plastics" with a symposium on Saturday morning, March 9, devoted to the important subject of "Cutting Tools and Materials". A large portion of these papers as presented by the authoritative speakers on the various subjects are reprinted in this issue of The Tool Engineer or will appear in succeeding issues.

Facts, figures, and the consensus of all who attended give the 1940 A.S.T.E. Annual Meeting warm praise. It is, once again, a criterion of the progress and the worth-whileness of an organization for Tool Engineers—America's pioneers on today's limitless industrial frontiers.



QUICK • ACCURATE ADJUSTMENT

ADJUSTABLE ADAPTER ASSEMBLY

This tool developed for the Automotive Manufacturers is now accepted and used by Drilling Machine Manufacturers and Production Plants. These adapters are furnished with an Acme or Standard V Thread ground on the outside diameter, furnishing a bearing on the front end of the adapter.

SCULLY-JONES & COMPANY
1907 South Rockwell St. ∴ ∴ Chicago, Illinois

TOOLING LARGE PRODUCTS

(Continued from Page 16)

chine? Cost of maintenance? Cost of housing machine? Cost of service and supervision? Cost of labor per hour? Compare this with the cost of small tooling necessary to continue operation on radial drill.

The economies of tooling, either small or large, require a minute analysis to determine the relation of tool types, machining, and assembly (the extent of small tooling and major tooling). To do this we must have the information pertaining to the direct and indirect cost of specific types of machines and assembly.

In making an analysis we so often consider the overall cost center which may be of a diversified equipment. Let us look at a typical case, in terms of percentage:

Cost Center Comparison Machining and Assembly of Related Product

Account	Machining %	Assembly %
Direct		
Depreciation—Machine Tools	9.70	....
Maintenance Equalization	3.14	....
Depreciation—Buildings	2.26	....
Maintenance of Cutting Tools and Fixtures	6.10	....
Total	21.2	6.7
Indirect		
Oiling	.075	....
Tool Crib	2.20	.226
Cutting Tools and Fixtures—General	.66	....
Furniture and Fixtures	.04	.090
Maint. of Furniture and Fixtures	.02	.040
Material Handling	2.82	.300
Maint. Material Handling	.024	.053
Hand Tools	.75	.200
Re-arrangements	.020	.016
Power	3.760	.067
Supervision	3.480	.167
Service—Planning and Inspection	10.800	6.700
Total	25.70	18.70

Overall cost center of machining increases—11%.

While the overall cost center on machining increases 11%, the direct cost increase is 14.5% and the indirect cost increase is 7.0%. Obviously further study is necessary to determine the remaining factors not mentioned as a part of the cost center.

Economies of tooling can be justified only on a pure machine-hour cost, and this analyzed with respect to the constants and variables.

Plant Layout

Plant layout has its effects on the economies of tooling, small and major, through the centralization or de-centralization. By centralization it is possible to eliminate the duplication of tools, especially when a full time load is not possible. This must be weighed against the cost and effect on production schedules, due to transport and intermittent delays, also control.

De-centralization tends to hide and eliminate the building up quantity on small lot similar parts which may afford universal adjustable tools with a minimum cost for component parts. Duplication of tooling, part time loaded, reduces the return on investment.

Service to tooling is an important factor in the economies of tooling. Through efficient service and proper location, idle tool time can be reduced to a minimum.

I have experienced instances where a commendable tooling job has been done, but lost its effectiveness due to poor service and handling facilities. Recently, we had a demand for an additional trolley on a 30-ton crane for turning over unusual jobs. At the moment it seemed logical to put the trolley on this crane because it was in the position that serviced the area, but further study brought to light changes in our manufacturing process and product, indicating that we should change position of a 50-ton crane and install the new trolley on it, at a cost of 15% more, with advantages of greater versatility in servicing the area and greater tonnage handled with two trolleys which would have been limited on the 30-ton crane. This change avoided a future expenditure of several thousand dollars which would have had to be done later to service the equipment being installed.

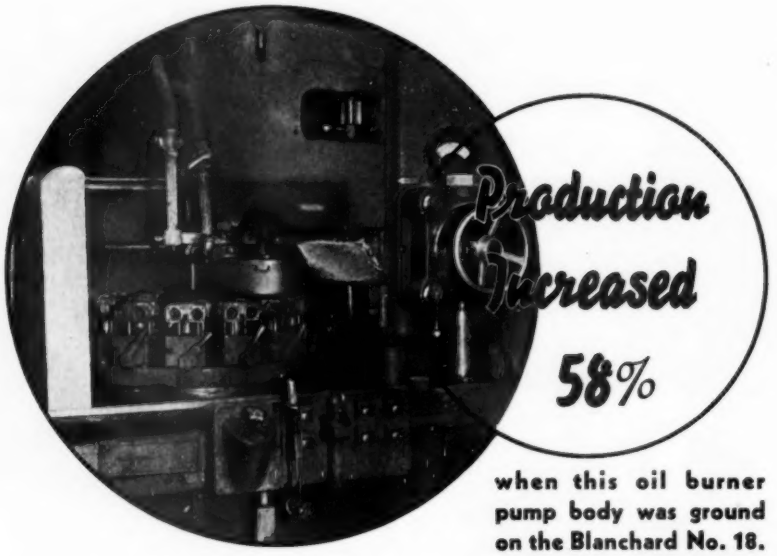
Summary

I have stated that regardless of the problem related to tooling, small or large quantity, there are certain fundamental principles common to all and to which common-sense judgment should be applied. These are:

a. Design demands duplication of existing standard tools,

b. Design demands special tools,

(Continued on Page 54)



when this oil burner pump body was ground on the Blanchard No. 18.

THE BLANCHARD NO. 18 is a versatile machine — versatile because of the variety of parts it will handle — versatile in that it may be used for both roughing and finishing cuts. The 6-inch diameter cast iron pump body, shown above, is ground to limits of +.0003" and −.0001" In this operation .012" of stock is ground off one side of each piece.

Group of parts ground on the Blanchard No. 18 shown at the left.

Blanchard cylinder grinding wheels, manufactured by the Blanchard Machine Company, are used on this job. This was another reason for being able to increase the production from 28 to 48 pieces per hour.

A second Blanchard No. 18 Surface Grinder was recently sold to this same shop on the basis of the performance of the first machine.

A complete study of your own grinding requirements will be made without obligation — just send us samples of your work with grinding instructions.

THE BLANCHARD MACHINE COMPANY
64 STATE ST., CAMBRIDGE, MASS., U.S.A.

SEND FOR YOUR FREE COPY OF THE BLANCHARD WORK BOOK

No. 1 of a Series of Interesting Case Histories

SUNNEN
Precision Honing Machine

Subject:

Production Increased More Than 100%

Limits of .00005 inch for straightness and roundness maintained

Here's how the Sunnen Precision Hone helped one manufacturer to step up production and lower production costs, yet maintain the highest degree of accuracy.

The job is that of finishing the cylindrical hole in a hardened steel compressor roller. Using the Sunnen Precision Honing Machine, enables this manufacturer to maintain .00005" limits of straightness and roundness and to secure a super-smooth finish. Production was stepped up to about 90 jobs per hour—an increase of more than 100% over the previous method. Sunnen Honing now corrects "tenth" errors more quickly and accurately than was possible with the more expensive equipment formerly used on this job.

Solves Five Problems for the Tool Engineer

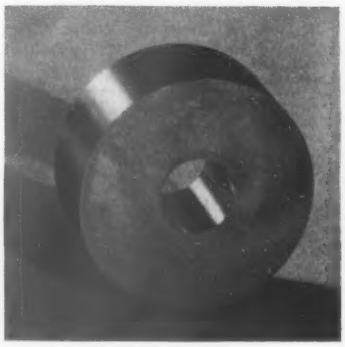
Because the Sunnen Precision Honing Machine solves the problem of small hole internal finishing, hundreds of manufacturers are turning to this low cost, accurate equipment and applying it to thousands of industrial uses. The Sunnen Honing Machine

- √ Corrects errors of out-of-round and taper produced by previous operations.
- √ Produces super-smooth surface finishes.
- √ Accurately finishes holes to very close tolerances as to size and straightness.
- √ Maintains alignment already established by previous operations.
- √ Provides a simple, low cost production method for accurately duplicating sizes.

It is ideally suited for assembly operations, repair and salvage work, short run production, tool room and experimental work and for the job shop. Hundreds of manufacturers of such parts as gauges, drill jig bushings, bearing races, automatic machinery, hydraulic cylinders, clevises, gears, valves, gyroscopes, instruments, pump parts, etc., are now using Sunnen Precision Honing Machines to correct errors, maintain alignment and finish their holes to extreme limits of accuracy and smoothness.

The Method of Guaranteed Accuracy

Not only is accuracy guaranteed, but production can be stepped up at the same time since the Sunnen Precision Honing Machine produces super-smooth surfaces, finishes and corrects errors of previous machining *in the same operation*. This is made possible because of the three point design of the Sunnen honing unit—using one



Compresser Roller

single abrasive stone supported by two parallel, unevenly spaced solid guide shoes. With this design, cutting can take place only on the high spots or smallest diameter first—no stock is removed from the largest diameter or low spots until the hole is round and straight. When specifications demand straight, round holes, there is no faster, more accurate method of finishing than the Sunnen Precision Hone.

Wide Range

The Sunnen Precision Honing Machine handles any straight round internal cylindrical surface free from full length key way from .245" to 2.400" diameter and up to 7" in length with a guaranteed accuracy of .0001"—providing positive alignment.

Let Us Prove It Free

Send us several samples of parts having internal cylindrical surfaces which you are now finishing by other methods and tell us your problems. We'll hone them to your specifications and return them with complete operation data.

Investigate the many profitable uses of the Sunnen Precision Honing Machine in your plant. For hundreds of others it is saving time, money and labor—it can do the same for you.

Write today for complete bulletin on Sunnen Precision Honing. It's free —no obligations.

Sunnen Model "MA" Precision Honing Machine

Four speeds give greater flexibility, more effective cutting in various kinds of metals. Dial micrometer stop adjustment permits setting the stone to remove only the desired amount of metal, prevents going oversize. Cutting pressure may be quickly set for light or heavy pressure. Foot pedal controls the mechanical operation of the machine—both hands are left free to work. Sunnen Precision Hone shipped complete with 1/3 horsepower, 110 volt, 60 cycle motor.

SUNNEN

SUNNEN PRODUCTS CO., **7932 Manchester Avenue**
St. Louis, Mo. • Chatham, Ont.

TOOLING SMALL PRODUCTS
(Discussion)

(Continued from Page 17)

must be held very closely it is beyond the scope of the factory to L/O and drill with the accuracy obtainable with a simple jig or fixture. Further, some customer's applications demand an interchangeability of parts. Obviously, this is a problem that can be solved only with the use of proper tools and when such a requirement must be met, the liquidation of the tool cost on a unit cost basis cannot be considered.

The Tool Engineer must be alert to these requirements, must weigh all factors that contribute to the consideration of tooling, and in his best judgment decide when a tool is required and the type or class of tool that will do the job.

How and by whom are new tools given consideration?

The answer to this may be aproached in several ways:—

1. Pre-planning of the major operations while on the design board. Full consideration is given at this time to methods of manufacturing taking into consideration economies by tooling and the type and class of tool necessary to give us the lowest unit cost. This pre-planning group consists of the Tool Engineer, the chief draftsman, the head planner, and the general foreman. Instructions are issued to interested departments so that these tools are designed and made to meet production schedules.

2. Review of existing methods and conditions by cost improvement activity. All operations by lines of apparatus are reviewed by a committee representing all phases of manufacturing and engineering and careful consideration is given to the effect that new or improved tools will have on our unit cost.

A few examples of this activity are:—

1. Adjustable tools that can be substituted for several individual tools, thus reducing replacements, storage, catalogue records, and overall tool investment.

2. The adding of inexpensive handling facilities to a production center or tool reduces overhead crane service and increases the productive efficiency of the operator.

3. Study has brought out that the application of inexpensive fixtures and hand tools has enabled one operator to perform an operation previously requiring two operators.

In the manufacture of diversified apparatus of this nature, it is necessary for the apparatus engineer and the Drafting section to have a good working knowledge of limitations on existing machine tools and an up-to-date record at all times of all smaller tools—patterns, dies, jigs, fixtures, gages, moulds, etc. —so that design can be made to take full advantage of existing tools. The only way this is and can be accomplished is for the Tool Engineer to set up in both the Engineering and Manufacturing Departments through the Planning Department simple catalogue records of existing tools and maintain these records by removing obsolete ones from it and adding new or changed ones to it.

We feel that we cannot reduce proper tooling on this type of apparatus to mathematical terms, if we accept the liquidation of tools on a unit cost basis as was so ably pointed out by Mr. Stegemerten. We feel that an organization that is geared to consider all phases of tool requirements, one that weighs all factors that determine when a tool is required, and one that is alert particularly to trends and improvements in the machine tool industry, will produce the desired results. Let us summarize:—

1. We expect our Tool Engineer to recognize our tool requirements. We expect him to design our tools economically and to the satisfaction of design department and to sell the tool to the foreman who will use it in production. Further, we expect the Tool Engineer to know and see that the tool is properly applied on the job for which it is designed.

2. We expect our application planners to plan processing on correct production centers and in correct sequence so that we are assured of a quality product at lower cost.

3. We expect supervision to use the tools supplied by the Tool Engineer

(Continued on Page 72)

How Else Could It Be Done So Economically?

Grinder set-up in Milling Machine grinding radius on metal-cutting saw.

STANLEY TOOL ROOM GRINDERS PLAY IMPORTANT PART IN MANUFACTURE OF FINE METAL-CUTTING TOOLS

Grinder bringing center holes of slotting saws to proper diameter.

Grinder burring off center holes of metal-cutting saws.

"Five years ago we bought our first Stanley Tool Room Grinder," reports Circular Tool Company, Inc., Providence, R. I. "The fact that the original one is still handling production work every day and that we have since added *three more* is endorsement enough of these handy little machines.

"Our products, metal-cutting tools, require precision grinding at several steps in their manufacture. We handle many of these steps *in regular production* on Stanley Grinders – jobs which would otherwise have to be taken to a large machine where time had been wasted making a complicated, costly set-up."

18,000 r.p.m. – ⅜ h.p. – ample to maintain high speed on tough work – complete flexibility to handle scores of shop jobs – these advantages mean savings for you with the Stanley Tool Room Grinder. Ask your Stanley distributor for demonstration, or write for literature. Stanley Electric Tool Division, The Stanley Works, 149 Elm Street, New Britain, Connecticut.

Have you complete information on Stanley Electric Contour Grinders, Unishears, Flexible Shaft Grinders; Bench Grinders, Sanders, Screw Drivers, Hammers, Saws and Drills?

STANLEY ELECTRIC TOOLS

A COMPLETE LINE FOR INDUSTRY – "COST LESS PER YEAR"

Get your next
PRODUCTION SAVING
through better Tools & Dies

IT'S SURPRISING how much you can reduce unit costs in this way—and how easily. All you need to do is to take full advantage of the extra latitude provided by modern tool steels.

For example, consider how often machines and presses are shut down because of such difficulties as "loading up," burrs, die scratches, galling, etc. Each time this happens, several minutes to several hours' output from a machine is irrecoverably lost—yet there are new steels that eliminate excessive shut-downs from these causes. By choosing the right steel for each job, you can step up the production of machines and presses by several hours to several days' output per month.

. . . And that's why so many tool makers use Carpenter's Matched Set of Tool Steels and Carpenter's Matched Set Method of Tool Steel Selection. Each Matched Tool Steel is a 100% acid disc inspected, electric furnace steel specifically developed to meet a particular combination of modern tooling requirements. The Matched Set Method quickly tells which Matched Tool Steel is the right steel for the job in hand—and gives the best heat treating procedure to follow to get the most out of that steel. You get fewer "time-outs," substantial increases in machine output and lower costs per unit.

Take this first easy step toward better tools. Without obligation, send today for a free copy of Carpenter's 60-page Matched Tool Steel Manual and see for yourself how Matched Tool Steels can simplify your tool making problems and help you get better tool performance.

THE CARPENTER STEEL COMPANY
READING, PA.

Carpenter
MATCHED
TOOL STEELS

Results like these:

274,000 PIECES BEFORE A BURR SHOWED UP!

This die set blanks and forms the lugs on the illustrated condenser wing bracket. Hardened without soft skin, the die turned out 274,000 pieces before throwing up an objectionable burr. Glass-hardness is only one of the many reasons why you can make more tools with No. 11 Special, the Matched Tool Steel used.

OVER 500,000 BLANKS WITHOUT REGRINDING!

This is a progressive lamination die for blanking and forming sheet fibre. The customer, using Carpenter's Matched Set Method, lost no time in choosing Stentor for the job. At the last report, over 500,000 blanks had been produced without any grinding or repairs. In addition to its other good qualities, Stentor is the easiest of all oil-hardening tool steels to machine.

FREE **This 60-Page Aid to Better Tools and Lower Costs**

1. Gives Matched Set Method.
2. Full information on 9 Matched Tool Steels.
3. New data on heat treating.
4. Hardening procedure.
5. Furnace atmosphere.
6. Quenching.
7. Drawing.

The Carpenter Steel Company,
122 Bern St., Reading, Pa.

Gentlemen: Without obligation, please send me your 60-page Matched Tool Steel Manual.

Name ..... *Title* .....

Firm .....
(FIRM NAME MUST BE GIVEN)

Address .....

City ..... *State* .....

TOOLING SMALL PRODUCTS
(Discussion)

(Continued from Page 20)

In order to render such a report, nothing takes the place of careful analysis of each part and each operation on each part.

The operation sheet we use gives—

1. The operation to be performed.
2. The cost of this operation.
3. The type of equipment on which the tools are to be used.
4. The type of tool, jig or fixture and cutter.
5. The estimated cost of drawings for these tools or the machines which are to be built.
6. The estimate cost of making or purchase of the tools or machines.
7. A list of the gages necessary for the operation.
8. The cost of these gages.

The analysis is as accurate and complete as we know how to make it.

If tools or machinery must be purchased, the sums given on the operation sheets are backed up by quotations from the suppliers.

Often two or more sets of operations are worked out for a single part and the report to the management gives an alternate figure for manufacturing cost and tool plant.

These operation sheets also show the cost of finishing, assembling and testing.

The cost estimates given on these sheets are obtained from those who are responsible later to meet them.

The sequence of operations and the operation costs are made jointly by the engineering department and the manufacturing department and are not final until both are satisfied.

The designing cost is estimated by the drafting department and the cost of tools and gages by the tool room.

These costs are checked and rechecked by the engineering department with those who make them before they go to the cost department for report.

The cost department next sums up these sheets and adds the proper overheads.

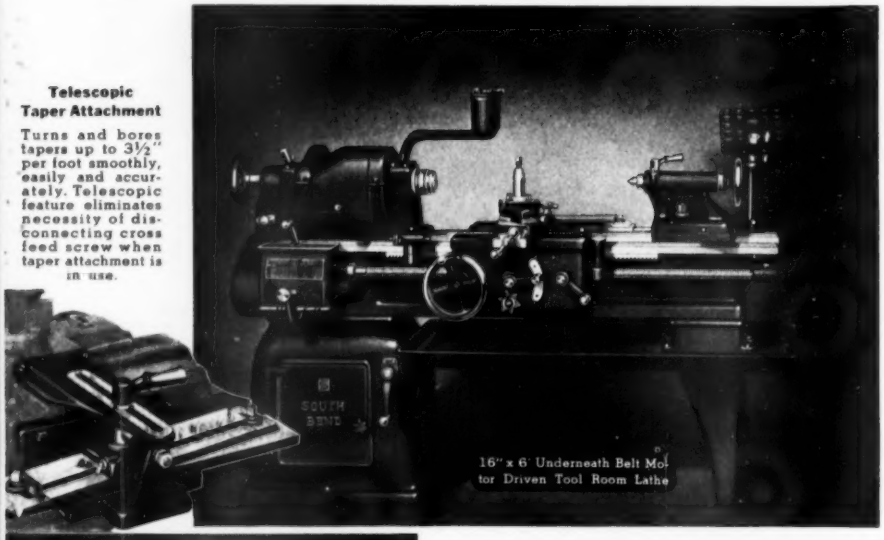
They then report to the management the estimated manufacturing cost of the new product and the cost of the tool plant to produce it.

To sum up, I wish to state—

1. That this discussion is based on experience gained in the tooling of very complicated and precise mechanisms. The new models presented to us for analysis differ widely in every way and cover a wide variety of mechanical arts.
2. I believe that with work of this kind, only a detailed analysis of every operation can determine the proper cost of a tool plant.
3. I believe that the method suggested by Mr. Darling might be valuable in industries who get jobbing orders for a definite number of parts which are similar to but differ in dimensions only from their regular product. It might also apply within a press department, or a screw department when the parts are not too unusual.

Telescopic Taper Attachment

Turns and bores tapers up to 3½" per foot smoothly, easily and accurately. Telescopic feature eliminates necessity of disconnecting cross feed screw when taper attachment is in use.



16" x 6' Underneath Belt Motor Driven Tool Room Lathe

13" x 5' Underneath Belt Motor Driven Lathe

10-inch swing 1" Collet Capacity Underneath Belt Motor Driven Tool Room Precision Bench Lathe

SOUTH BEND LATHES · FOR REAL EFFICIENCY

In all classes of industry South Bend Lathes are meeting the need for real efficiency in precision machine work. All types of operations, from heavy roughing cuts on production work to precision finishing in tool and gauge departments can be economically performed on South Bend Lathes, because they have ample power, extreme accuracy and an unusually wide range of smooth, vibrationless spindle speeds.

SIZES AND TYPES

Manufactured in 9", 10", 11", 13", 14½", and 16" swing. Bed lengths 3' to 12', Quick Change and Standard Change Gear types. Motor Drive and Countershaft Drive. Attachments are available for production, tool room, laboratory and general machine work.

New South Bend Lathe Catalog

Write today for a copy of our new 112-page catalog describing all sizes and types of South Bend Lathes.

SOUTH BEND LATHE WORKS
477 E. Madison Street
SOUTH BEND, INDIANA, U. S. A.

Lathe Builders Since 1906

CHARLES J. TRAUTMAN DIES

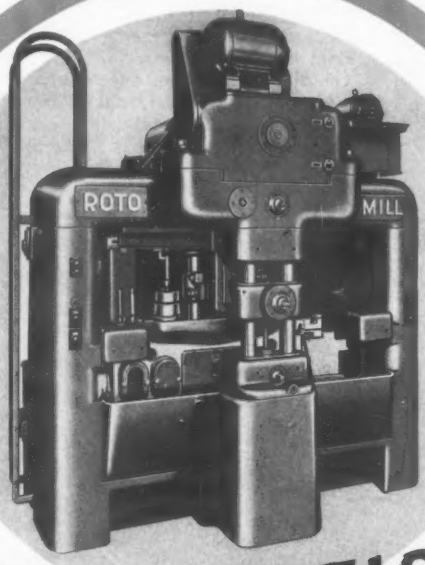
The Cleveland Chapter expresses deep regret and sympathy for the family and many friends of Charles J. Trautman, who passed away suddenly March 15th at his home at 16900 Euclid Avenue.

He was the brother of the late Dean William Trautman of Western Reserve University. He was also a Mason. He is survived by his beloved wife, Fern (nee Bartlett) and his sons Jean E. of San Francisco, Cal., and Charles A., his sister Amalia Trautman and his brother Harry.

Mr. Trautman was a designer with the National Carbon Co. from 1923 to 1926. He was also with the Cleveland Tractor Co. as a tool designer for many years. He had many friends and we express the opinion of all when we say — Charlie we will miss you.

Turn now to page 21 or page 22 and use the coupon thereon to get your copies of the complete transactions of the A.S.T.E. Annual Meeting—including all the discussions, which for lack of space cannot be given in this issue of THE TOOL ENGINEER. Single copies to members are one dollar — to nonmembers each copy, two dollars. Orders for twenty-five or more copies may be had at special prices.

RED RING ROTOMILL



CUTS PRODUCTION TIME AND COST

RotoMilling is a fast, accurate, low cost operation for turning out cylindrical, conical or flanged work pieces, the diameter of which does not exceed 10" or the length 24".

In one large automobile plant a RotoMill has replaced two machines which previously turned steering arms. By the change, production per man was doubled and accuracy materially increased. Actual production now is 150 pieces per hour with a tolerance of .004" on both diameter and run-out. From 2500 to 3000 pieces are produced for each cutter sharpening.

Two operators set up the RotoMill in about 80 minutes (cutter change requires about 20 minutes), consequently it is applicable to both long and short runs. Write for detailed description of the Red Ring RotoMill.

NATIONAL BROACH AND MACHINE CO.

5600 ST. JEAN • DETROIT, MICHIGAN

Patents issued and pending 2,141,191 and 2,036,967

TOOLING LARGE PRODUCTS

(Continued from Page 48)

c. Small quantity can be adapted to existing tools,
d. Small quantity demands universal tooling with conjunction parts,
e. Large quantity demands special small tools,
f. Large quantity demands special machine tools,
g. Large quantity demands standard machine tools,
h. Production schedules demand tooling new or duplication,
i. Labor content demands tooling,
j. Tolerances demand tooling,
k. Quality demands tooling,
l. Interchangeability demands tooling,
m. Type and class of small tools,
n. Cost of small tools,
o. Type and class of major tools,
p. Cost or depreciation of major tools,
q. Plant layout demands duplicate tools,
r. Direct charges on major tools,
s. Indirect charges on major tools,
t. Plant expansion effected,
u. Handling equipment effected,
v. Value of floor space occupied.

The purpose of this symposium is to develop a formula for economic tooling. I should like to offer a concrete common-sense judgment and questioning analysis expression, which can be used as a guide. Considering the factors listed in the previous paragraph, the expression or formula would be:

x = economical unit cost value to product design.

$$\frac{a+b+j+k+l}{\text{No. of units}} = x$$

y = minimum indirect hidden unit cost value reflecting future management control.

$$\frac{q+s+t+u+v+m+n+o+p}{\text{No. of units}} = y.$$

z = minimum direct known unit cost value reflecting management control.

$$\frac{c+d+e+f+g+h+i+(m+n+o+p)+r}{\text{No. of units}} = z.$$

Therefore, $x + y + z$ = economics justifying tooling.

It would appear that for a real economic analysis in tooling a machine-hour cost and a man-hour cost should be developed for all classes and types; even though they are not used in costing centers, they would aid in the control of the return on the investment.

Plant expansion can be avoided by proper tooling and layout.

Gradual increase of machining load may bring on plant expansion if proper analysis is not made. We must keep in mind that fixed charges keep appearing on the operating statement regardless of production load, and the supervisor is helpless in controlling the uncontrollable.

A diversified plant has difficulty in loading all tools within the plant, even with a normal back log. It may show a favorable return on the product cost but unfavorable return on the investment.

Fellow Tool Engineers, it is our duty to recognize the responsibility that is upon us, to practice the economics of tooling, both small and large, in an effort to maintain a fair return on the investment; not through the elimination of tools but by the proper application.

VISUAL MACHINE FINISH

(Continued from Page 32)

task is justifiably a joint tool engineering and product engineering problem. Methods, problems, and costs are of as great importance as are functional design problems. Cooperation and coordination are essential for the best net results. Hence, the ultimate selection of surface quality for any given part must be a joint shop and engineering decision.

Equally important is the definiteness of finish specification as it affects the establishment of time standards or setting of rates. The time study or rate setting department thus has something tangible with which to figure.

In the shop proper if definite finish standards have been specified, there exists, in effect as mentioned before, specific instructions as to feeds, tool radius, wheel grit, etc., as well as a definite knowledge as to what is acceptable and what is not. There is no excuse for any operator or machinist to put a finer finish than required. To do so means only that either he or the company or both, is going to lose

(Continued on Page 60)

FOR ALL METAL STAMPING
—EASY OR "TOUGH!"

By imparting the RIGHT degree of the RIGHT type of ANTI-WELD VALUE to the stamping or deep-drawing lubricant—the use of

Stuart's "SUPER-KOOL"
EXTRA HEAVY DUTY DRAWING COMPOUND

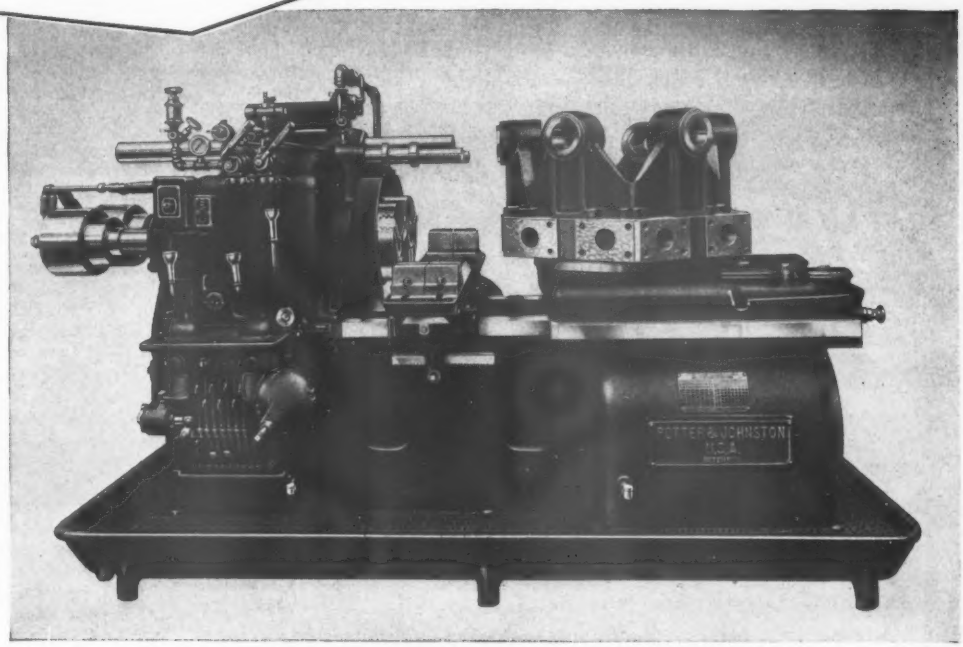
offers a tested method for effecting worth-while production improvements and economies

WIRE COLLECT OR WRITE TODAY FOR FREE WORKING SAMPLE AND DETAILED INSTRUCTIONS FOR INDIVIDUAL APPLICATIONS

Address request for free sample to General Offices, 2727-2753 South Troy Street, Chicago

D. A. STUART OIL CO. LTD.
ESTABLISHED 1865
CHICAGO - - - - - U. S. A.
Warehouses in Principal Industrial Centers

THE MUCH-NEEDED 2-SPINDLE P&J AUTOMATIC



These new P&J Bulletins give detailed specifications for the entire P & J line of Automatic Chucking & Turning Machines, including this latest 2-spindle 5D-2-9" Machine. Write for your set of Bulletins, mailed at no obligation to you.

Several years ago P & J introduced a 12" Automatic Chucking and Turning Machine as a 2-spindle complement to the well known line of P & J Power-Flex Automatics. Somewhat later another 2-spindle P & J Automatic, designated as the 5DE - 2 - 15" model, was added to provide for greater swing. These two machines filled the void which existed in the automatic chucking machine field. Their success and popularity emphasized the need for a similar 2-spindle machine in the intermediate range of production. To satisfy that need, P & J produced this NEW 5-D-2-9" AUTOMATIC—another 2-spindle machine to efficiently handle moderately sized work which would ordinarily come within the scope of the single spindle size 4D P & J Automatic. Thus, for better, faster and more economical manufacture, P & J now offer three highly efficient, highly productive 2-spindle Automatics.

POTTER & JOHNSTON MACHINE COMPANY, Pawtucket, R. I., U. S. A.

REPRESENTATIVES AND AGENTS IN UNITED STATES—William L. Martin, Headquarters at Factory: New England States and Eastern New York and New Jersey; A. W. Stone, 986 Kenyon Ave., Plainfield, N. J.; Western New York and New Jersey, Eastern Pennsylvania, Maryland and Delaware; G. Tell DuBois, 8-154 General Motors Building, Detroit, Michigan: Michigan and the City of Toledo, Ohio; Louis K. Voelk, 14014 Woodworth Road, East Cleveland, Ohio: Ohio—with the exception of Toledo, and Western Pennsylvania; Harry I. Schuster, 743 N. Fourth Street, Milwaukee, Wisconsin: Illinois, Missouri, Wisconsin, Iowa and Indiana; Star Mchry. Co., 1741 First St., South Seattle, Washington; Henes-Morgan Mchry. Co., 2026 Santa Fe Ave., Los Angeles, Calif.; Jenison Mchry. Co., 20th and Tennessee Sts., San Francisco; Wessendorff, Nelms & Co., Inc., 320 Franklin Ave., Houston, Tex. AGENTS IN FOREIGN COUNTRIES—Arthur Jackson Machine Tool Co., 60 Front Street, West, Toronto 2, Ontario, Canada; Arthur Jackson Machine Tool Co., 437 Grosvenor Ave., Montreal, Canada; Burton Griffiths & Co., Ltd., Birmingham, England; R. S. Stokvis et Fils, Paris, France; Rotterdam, Holland and Brussels, Belgium; Maskinaktiebolaget Karlebo, Stockholm, 1, Sweden; Ing. Ercole Vaghi, Milano, Italy; Yamatake & Co., Ltd., Tokyo, Japan (Imperial Export Co., 44 Whitehall Street, New York, N. Y.); Almacoa, Zurich, Switzerland.

TOOLING SMALL PRODUCTS

(Continued from Page 19)

are certain classes of work, such as spraying and buffing, where the tools are simple and where they are used to obtain a result and are not expected to effect much economy.

Chart (number 4) shows such a case, where, as we progress along the scale of tooling, the saving in labor is slight. When we add to the cost of labor, the cost of tooling, the curve for total cost does not display the same characteristics as the one with which we have been dealing in this paper. We find that even the smallest degree of tooling results in increased cost. But, nevertheless, our rule applies and the class of tooling dictated by the minimum point is at the extreme left of the chart, where we, in fact, provide for no tooling at all.

In a case like this, I can only suggest that the least amount of tooling is the best amount of tooling, and hope that the amount of tooling for such work in your plant is so small as to be negligible.

Now, in review, let me emphasize the following things concerning the approach to this problem that has just been outlined.

I—The type of reasoning applies to large groups of parts and we should not forget that exceptions to the rule will exist on individual parts in such a group. The treatment is similar to that used by insurance companies who are willing to stake their chances on mortality curves which accurately forecast the average age at which a large group of men will die, even though they fail to predict the age that you or I, as individuals, will attain. Accordingly, this

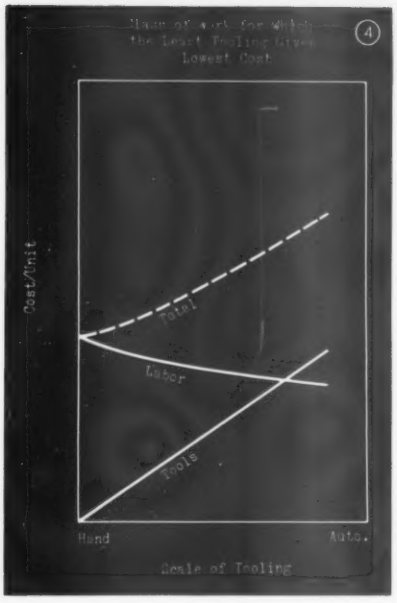


Chart No. 4

analysis may point to type B tooling and a $200 tool cost per part as most economical and at the same time specific parts may require tooling well above that figure and well below it. Nevertheless, the average will hold good.

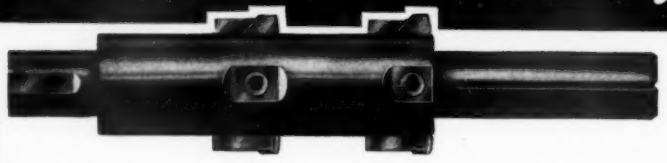
II—If by such a survey the tool engineering department forecasts a series of diminishing costs with increasing tool investment, they are, in effect, making the promise, "We, by actual trial, have proven what management might expect of us in the way of reduced production cost, given certain sums of money to spend." Unless you are willing to give such an estimate of your ability to produce certain returns for given investments, no one, not even yourselves, can attempt to answer this problem.

III—Referring again to this, "promissory" curve, we can expect that it will be differently shaped as new processes are introduced in your industry. One might also expect to find that it will change as the organization of the tool department changes. It would be dangerous, therefore, to suppose that it is a fixed thing, as good next year as it is today. It is my feeling that additional surveys should be made whenever radical changes in products, processes or organization have been effected.

IV—Many of you will no doubt have noticed that I have utterly neglected the factor of profit or return on investment. Now this is a very important consideration that the manufacturer may not ignore, but as far as the tool designer is concerned if he has given the most return for the money invested he has done the best he can. If having done that, competition or lack of the buyer's demand at the resultant price makes the venture unprofitable, then no manufacturing can be started. At that point, we enter upon another phase of cost reduction which involves redesign of product and the development

(Continued on Page 72)

For FASTER PRODUCTION— ACCURATELY, ECONOMICALLY!

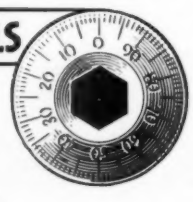


In hundreds of shops, under all sorts of conditions, this famous Davis Expanding Block Type Boring Tool has invariably brought about faster production, better work, lower costs.

The uniformity of design and interchangeability of Davis Blocks enable six bars to cover the entire range of bores from ¾" to 18" inclusive. Special blocks with two or more cutter arrangements for step boring can be supplied.

Send us prints of your work for a specific, money-saving recommendation. No obligation. Write us today.

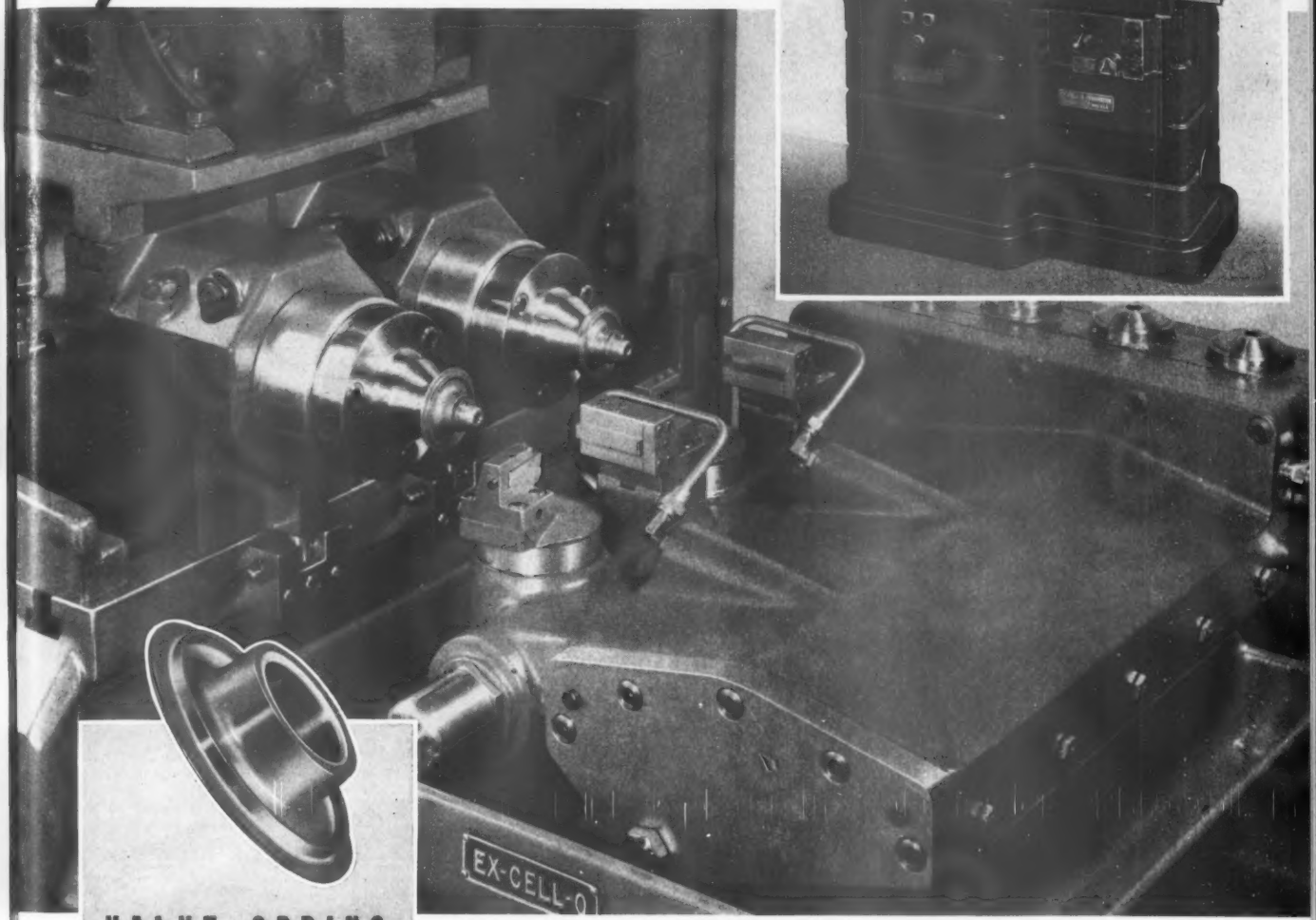
DAVIS BORING TOOLS



DAVIS BORING TOOL DIVISION
Larkin Packer Company, Inc., St. Louis, U.S.A.

TO MEET INDUSTRY'S *Greater* DEMANDS

Ex-Cell-O Junior Single End Precision Boring Machine, Style No. 2112A.



VALVE SPRING RETAINER WASHER

MATERIAL: SAE 6150.

OPERATION: Turn O. D. of hub, turn radius, face, bore rim flange, turn and face outer flange.

DIAMETER TURNED: 2" O. D.

MACHINE USED: Ex-Cell-O Junior Single End Precision Boring Machine.

STATIONS: Two.

PRODUCTION: Approximately 75 per hour.

DETAILS: Part is loaded onto arbor and secured by draw rod and "C" washer. *Fully automatic fixture.* Tripping control lever advances tool, turning the hub. Then tool is hydraulically rotated to form radius. Slide moves laterally for facing operation and fixture backs away, boring rim. During this cycle, another tool faces and turns outside of rim. Fixture returns to starting position to complete the cycle.

WHEREVER the problem of industry is boring, turning, facing . . . on a production basis . . . with improved accuracy and finish . . . the installation of Ex-Cell-O Precision Boring Machines is the one sure step to the saving of time and money.

For instance, the operation shown here is typical of hundreds of production problems solved successfully through the use of the Ex-Cell-O Junior, Single End Precision Boring Machine . . . resulting in worthwhile economies—through reduction of rejections and minimizing of inspection—in both manufacturing of the product and final assembly process.

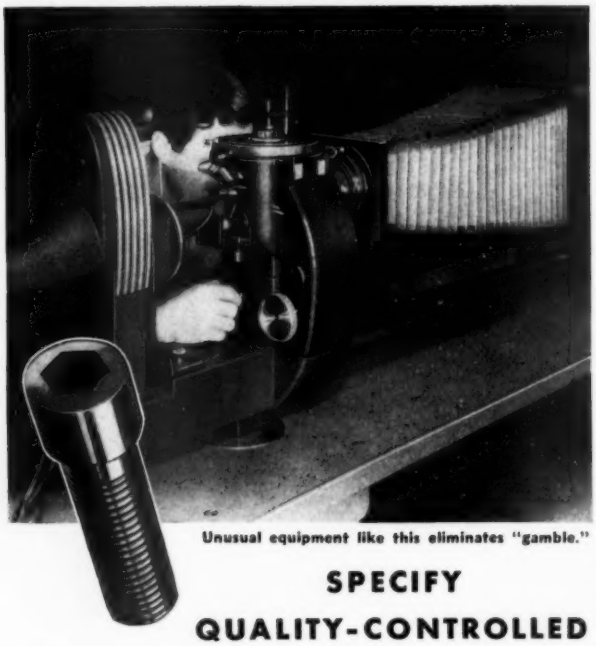
If your problem is boring, turning, facing . . . simple or difficult . . . Ex-Cell-O has a Precision Boring Machine to meet your need exactly and economically. Send us details of your requirements, or ask for catalogs on Boring Machines.

EX-CELL-O CORPORATION • 1204 OAKMAN BLVD. • DETROIT, MICH.

EX-CELL-O *Precision* MACHINES AND TOOLS

DON'T GAMBLE

WITH DOUBTFUL SCREWS!



Unusual equipment like this eliminates "gamble."

SPECIFY QUALITY-CONTROLLED PARKER-KALON SOCKET SCREWS!

It doesn't cost you a penny extra to use Parker-Kalon Socket Screws! And, you get unique protection against any "doubtful" screws . . . screws that might play hob with assembly efficiency, or fail in service.

Such protection has become available only since Parker-Kalon established a $250,000 laboratory to provide rigid quality control. Today, every Parker-Kalon Socket Screw is *bound* to measure-up in all characteristics after passing the 16 Parker-Kalon Quality-Control tests.

Tangible evidence of all this care is the Guarantee you get in every box. Order PARKER-KALON next time! For free samples and local distributor's name, Parker-Kalon Corp., 190-198 Varick Street, New York.

Quality-Controlled

16-point test and inspection routine covers: Chemical Analysis; Tensile and Torsional Strength; Ductility; Shock Resistance under Tension and Shear; Hardness; Head diameter, height and concentricity; Socket shape, size, depth and centricality; Class 3 Fit Threads; Clean-starting Threads.

PARKER-KALON
COLD-FORGED
Socket Screws

April Chapter Meetings

BALTIMORE

April 8, 1940—Dinner 7:00 P.M. Technical Session 8:00 P.M., Sears Auditorium, North Avenue and Harford.

Speaker: Major Theodore R. Snyder, Ordnance Dept., O.R.C., Industrial Engineer for the Reconstruction Finance Corp.

Subject: "Production Engineering and Its Relation to Management."

For dinner reservations: Nils H. Lou, 3515 Glenmore Ave., Baltimore, Md., Phone, Hamilton 0851.

BUFFALO

April 11, 1940—Dinner 6:30 P.M., University Club, 546 Delaware Avenue. Technical Session 8:00 P.M.

Speaker: Walter K. Bailey, Sales Mgr., Warner & Swasey Co.

Subject: "Telescopes and Turret Lathes." Moving pictures and slides.

CLEVELAND

April 11, 1940—Dinner 6:30 P.M. Allerton Hotel, 13th and Chester Avenue. Technical Session 8:00 P.M.

Speaker: R. O. Burnst, Supt. U. S. Tool Company, Inc., Ampere, N. J.

Subject: "Multiforming Operations and Multislide Machines," illustrated with movies.

Dinner reservations: Call William Reiff, Jr., The Cleveland Duplex Machinery Co., Inc., MAIN 0112.

DAYTON

April 8, 1940—Dinner 6:30 P.M., Manchester Hotel, Middletown, Ohio. Installation of officers. 7:30 P. M. Movie on Paper Making.

Speaker: Jos. Baxter, Chief Pulp and Paper Eng. of Shartle Bros. Mach. Co., Div. of Black & Clawson Co., Middletown, Ohio.

Subject: "Pulp and Paper—Scientific Manufacturing Methods."

8:30 P. M., Trip through Sorg Smith & Oglesby Paper Mills.

DETROIT

April 11, 1940—Dinner 6:30 P.M. Webster Hall, Cass at Putnam. Installation of officers 8:00 P.M. Technical Session 8:30 P.M. Coffee speaker, E. A. McFaul of the Public Relations Department of Industrial Morris Plan Bank. Subject—"Keep your foot out of your mouth".

Technical Speaker: Ralph A. Powers of the Electronic Control Corp.

Subject: "New Adaptations of Electronic Discharge Devices to the Automotive and Allied Industries."

Members of the society who phone their reservations to the A.S.T.E., Tyler 5-0145 on or before April 9 may purchase tickets at the door for $1.25. Members without reservations and all guests will be charged $1.50 at the door.

ELMIRA

April 12, 1940—Dinner 6:30 P.M., Ingersoll-Rand Club, Athens, Pa. Plant visitations start at 3:00 on that day. Technical meeting at 7:30.

Speaker: Walter K. Bailey, Warner & Swasey Co.

Subject: "Telescopes and Turret Lathes."

Tri-City Chapter
MOLINE - ROCK ISLAND - DAVENPORT

April 3rd at the LeClaire Hotel Ski-Hi Ballroom, Moline, Illinois.

Dinner at 6:30 P.M. as usual.

Speaker: Mr. Forest T. Ellis, of the Heald Machine Company, will speak on: "Borizing—Precision Finishing of Surfaces."

ONTARIO

April 12, 1940—Oak Room, Union Station, Toronto.

Speaker: "Ira Snader, The Ex-Cell-O Corp., Detroit.

Subject: "Thread Grinding."

PITTSBURGH

April 12, 1940—Dinner 6:30 P.M., Penn Lincoln Hotel, Center and Penn Avenues, Wilkinsburg, Pa. Dinner Speaker —Chairman J. P. Wiley will talk on the Annual Meeting at New York. Meeting, 8:00 P.M.

Speaker: Everett Chapman, President Lukenweld Company, Inc.

Subject: "Welding and Welded Structures." Motion pictures and slides. This is an interesting subject which will be handled by an able speaker who knows all phases of welding. Is this a date?

RACINE

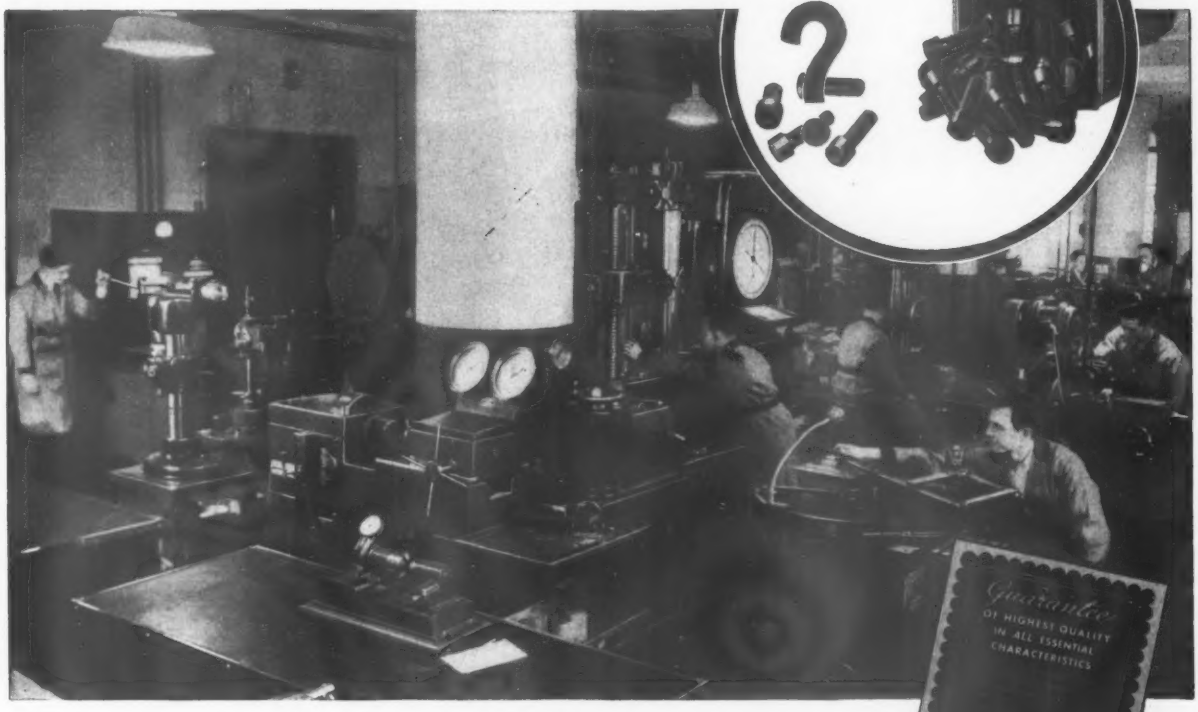
April 8, 1940—6:30 P.M., Hotel Racine main dining room.

Speaker: C. J. Oxford, Chief Engineer of the National Twist Drill

(Continued on Page 76)

NO *Doubtful Few*

To "Gum-Up" Fastening Jobs



...When Parker-Kalon's Quality-Control Laboratory guarantees fastening devices

EVEN a few imperfect screws in a box can "gum-up" assembly work ... waste time, boost costs, fail to make satisfactory fastenings. That's why thousands of plants specify Parker-Kalon and avoid all troubles caused by the "Doubtful Few."

Parker-Kalon Fastening Devices are made to standards that permit no "Doubtful Few"... standards that could only be attained when Parker-Kalon established a $250,000 Quality-Control Laboratory. Without counterpart in the industry, this laboratory applies a unique scientific control-routine to insure that Parker-Kalon Fastening Devices always work right and hold tight.

It pays to buy Hardened Self-tapping Screws, Socket Screws and other fastening devices that are made in the most modern plant in the screw industry. Parker-Kalon Corp., 190-198 Varick St., New York.

COSTS NO MORE *to get this Parker-Kalon Quality-Control Guarantee with every box of ....*

Hardened Self-tapping Screws
Types, sizes, head-styles for every assembly of metal or plastics

Cold-forged Socket Screws
Cap Screws, Set Screws, Stripper Bolts made to a new high standard of quality

Wing Nuts-Cap Nuts-Thumb Screws
Cold-forged .. Neater, Stronger

SOLD ONLY THROUGH RECOGNIZED DISTRIBUTORS

Quality-Controlled **PARKER-KALON Fastening Devices**

SMALL GEARS — REQUIREMENTS

(Continued from Page 22)

the total range is from 7 to 250 teeth. Practically all types of gears are cut in this plant, with practically all types of materials used in the gears. The machines used here are the Fellows Gear Shapers predominantly, together with Barber Colman machines and other special gear cutting equipment.

All the metal gears used are burnished and if the gears are hardened there is of course a lapping operation after. The tooth form is the involute and the allowable error is .001 as shown by the indicator reading or .0005 eccentricity. The tooth profile must be accurate within .0002 for involute.

Gears for sound projection must be accurate to within .0003 for cumulative error and each gear is checked on a Fellows Red Liner. Sound Sprockets must be within .00025 for tooth spacing and .0002 for runout indicator reading.

The methods used in checking are by Projector and Red Line Test which is used 100% on some gears and only for setup checking on others. A 100% check is made against a Master Gear mounted on a slide, attached to an indicator.

From this information perhaps we could draw a conclusion that an American made machine may fit into the picture under the heading of other special gear cutting machinery.

From the Brown & Sharpe Co. and other companies we have developed that in addition to the machines already mentioned there is another foreign made machine which has a good reputation and that is the Schuchardt & Schutte machine.

From the Waltham Watch Company I received this information: Their pitch ranges are from .07 to .275, and the number of teeth are from 6 to 300; the material used is steel and brass. The kind of gears are straight. And the tooth form is epicycloid and involute.

The tolerances are plus and minus .01 millimeters, and they use the projection method of inspection. And of course they use the Waltham machines.

From the Seth Thomas Clock Company this information is forwarded! They use blanked teeth with the principal mass production clock in the lower price clock range. On the cut wheels they cut with the index method using from one to three cutters in succession on special machines either hand operated or with automatic indexing. Machinery for this type is manufactured by the Waltham Company.

On their hobbed wheels, the typical equipment for this manufacturing method is made by the Barber-Colman Co., Rockford, Illinois, Mikron in Switzerland, and others.

The Triplex Machine Tool Corp. tell me they can still get Mikron machines in spite of the war. I am not giving you a talk here for machine tool manufacturers, I am trying to pass on what the industry needs and what industry has.

In conclusion I would say there has been developed a need for domestic made machinery to compete with the efficient foreign made machine tools now in use in the gear cutting industry.

While no claim is being made that this is a conclusive survey it, nevertheless, does point to the lack of American made equipment to fill this need, forcing the manufacturers to import equipment where needed and as this source of supply is now shut off, I believe the opportunity is ripe for some machine tool manufacturer to really enter this field.

ASSURED
PERFORMANCE
For Your Centerless Grinders
ABRASIVE COMPANY GRINDING WHEELS have proved their worth on many hundreds of centerless grinding jobs and are in standard use by many of the largest and most "fussy" operators of centerless machines.
Their use will assure you of the best performance of which your centerless grinders are capable. "Best wheels ever used" is a frequent remark after ABRASIVE Wheels have been placed in service.
Extensive experience in this specialized field of grinding enables us to submit grain and grade specifications that lick the tough jobs! Manufacturing improvements include better wheel balance, greater uniformity throughout the wheel and ground center holes for better spindle fit.
ABRASIVE Centerless Grinding Wheels cut fast and free, break down uniformly, thus require less dressing and have longer wheel life. Try them on your work—for improved production.
Details gladly sent to meet your circumstances of use.
ABRASIVE COMPANY
Division of Simonds Saw and Steel Co.
Tacony and Fraley Streets
Philadelphia, Pa.

VISUAL MACHINE FINISH

(Continued from page 54)

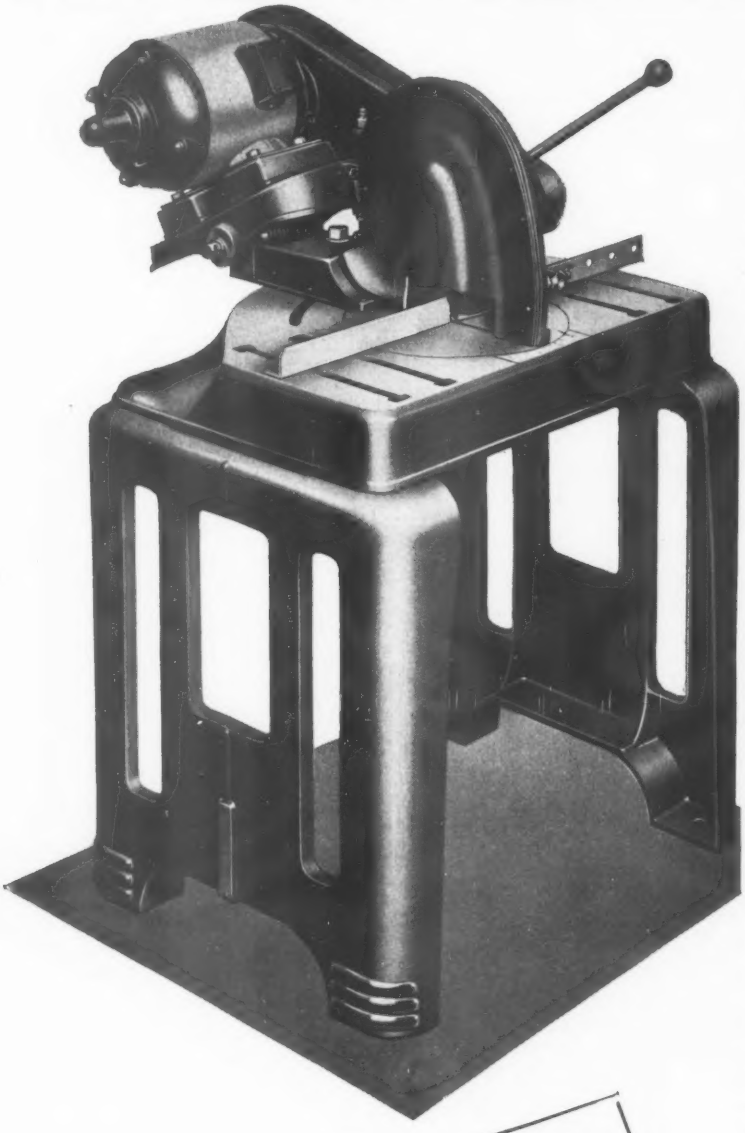
money. On the other hand, excess rushing and roughing a job then is held in check.

Finally in the inspection department there exists a positive means of determining whether the "finish on the job" is passable or not.

The logical place for any finish standard or surface quality specification to appear is on the blueprint. There are a number of ways of showing this. In the system the writer has set up, the char-

(Continued on Page 72)

NEW LOW COST Cut-Off Machine!



. . . AT A FRACTION OF CUSTOMARY PRICES

A powerful, accurate Abrasive Cut-Off Machine designed by Delta and built according to best engineering practice—is now available for less than half the usual price of machines of this type! Thats news—good news! It can be used everywhere, in large shops or small, where material of any kind has to be cut to accurate length on a production basis. At these remarkably low price levels you can actually get two cut-off machines for the price of one—machines that can be used for scores of jobs, and quickly pay for themselves in time and money saved!

CUTS PRACTICALLY ANY MATERIAL

This new Delta unit has an unusually wide range of applications. It will cut speedily and accurately to exact lengths such materials as steel, brass, copper, cast iron, monel metal, bakelite and all plastic materials, pipe, wire, rope, stellite, tool steel, manganese steel, fibrous material such as brake linings—tile, brick, carbon, porcelain, slate, hard rubber, concrete coping and sand cores. On metal it leaves the cut with a polished surface, thus eliminating many burring and finishing operations.

√ CHECK THESE MANY FEATURES

This improved Cut-Off Machine is ruggedly constructed with heavy castings throughout—wide spaced Timken roller pivot bearings and double arbor sealed-for-life bearings requiring no lubrication—powerful Texrope V-Belt drive—adjustable fence—accurately machined table. It is perfectly balanced, making for easy operation—cuts material at any angle and embodies unusual safety features such as husky chip guard, belt and wheel guards. Capacity up to 2 inches diameter, or material up to 2 inches by 6 inches. Shipping weight, less legs, motor, V-belts, motor pulley or abrasive wheel, 370 pounds.

DELTA Mfg. Co.

Industrial Division

633 EAST VIENNA AVENUE

MILWAUKEE, WISCONSIN

Send for "Cut-Off" Bulletin

giving full details and prices on the Delta Cut-Off Machine and all accessories.

Delta Manufacturing Company
633 East Vienna Avenue, Milwaukee, Wis.
Please send me special bulletin on the new Delta Cut-Off Machine. ☐ Also send latest Delta Catalog of Industrial Power Tools.

Name .....
Address .....
Firm .....
City ..... State .....

(Continued from Page 42)

for white-collar and professional jobs, and neglecting to create the necessary skilled workers for public and private industry. . . . Our youth gravitates toward white-collar jobs out of totally outworn social snobbery. Many of the overall jobs take far more brains and skill than the white-collar jobs, and the pay is better. But most young people look for work that is more 'genteel' in a world where . . . the 'genteel' occupations are the ones society can most easily do without. If the same prestige went with shoemaking that goes with show salesmanship—and it certainly should—we would have more young people of fair education willing and eager to work with their hands." (unquote).

Here in itself is a man-sized job—to change opinion fostered by generations of tradition, and partly responsible for what amounts almost to a social caste system. But even if this state of mind could be changed overnight, youth would still be poorly equipped. Mere enthusiasm for work in the mechanic arts is not enough. Thousands of young fellows have the enthusiasm, but not much else to qualify them. They need to be trained for a career in the manual arts from the time they enter high school, just as some youths are groomed for the legal or medical professions. I have been told that only about 15 per cent of our high school graduates have the privilege of continuing their education in college. The other 85 per cent graduate from secondary schools with practically no training to fit them for the business world. Our public secondary schools ordinarily provide only two courses of instruction—academic and commercial. Most young fellows take the academic course, which gives them no foundation from which they can grow into useful positions in industry.

It seems that our educational system has been molded to fit the needs of the more privileged 15 per cent of youth, while the 85 per cent is added to the dole, the CCC, and the WPA—this in spite of a desperate industrial need for new workers.

This large majority of our young people—notice I do not call them underprivileged, because they are eligible to become in the next few years a part of the most exciting, most satisfying industrial epoch this nation has known—this majority should be recognized at once by our educators. They should be trained in such a way that would fit them for specific jobs when they graduate. If an individual has mechanical aptitude, he should be encouraged to develop it as far as possible, by building and operating machines, by attempting to design his own machines or tools, or by making patterns. The chap with analytical inclinations could be taught something about production methods, accounting, or time study. With the groundwork laid, industry could accept these young fellows and fit them for useful lives in industry with a minimum amount of training.

We, as Tool Engineers, are particularly interested in Tool Engineering education. We are also getting older, and we would like to see about us more strong, eager young hands to help carry the mounting burdens of production. So far as I know, no college is actually teaching Tool Engineering. As we know it, Tool Engineering requires the knowledge and experience necessary to enable a man to start with a complex design, specify the best means of tooling it, recommend and supply the machine tools, conveyors, buildings, and other manufacturing facilities. It means knowledge of how to lay out the proper sequence of operations and produce the best product at the lowest price. This is a big job. It is a bigger job, in my opinion, than any engineering subjects now taught in colleges. Yet no college has ever taught it.

Some schools approach this particular problem; however, their courses will have to be expanded radically to meet the requirements of Tool Engineers. With careful planning and closer cooperation with industry, it should not be difficult for colleges to develop such a course, because fundamentally a tool engineering curriculum would consist of tool and machine design, tooling lay-

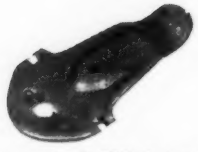
(Continued on Page 66)

STAMPED PARTS cost less made COMPLETE at each stroke on

HENRY & WRIGHT DIEING MACHINES

Costs Cut 60% to 90%

In automotive, airplane, ammunition, electrical and other plants throughout industry, the unique Dieing Machine is cutting stamping costs to unheard of low figures. Direct production costs often drop 60% to 90%. Die life increases an average of 600 to 900% (at times 1400%.) Product accuracy can be maintained to .0002". Superior smoothness and precision at high speeds result from unique features including Indirect Underdrive and Precision-guiding of upper crosshead. Investigate this MODERN machine and its possibilities for savings in YOUR plant!



Heavy part of .156" hot rolled steel produced 2 complete per stroke, 7600 per hour.

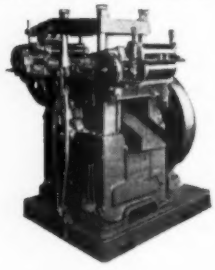
This piece produced complete at every stroke, 18 gage cold rolled steel.

8 operations performed at every stroke produce 4,800 completed shells per hour. .050" steel, with 1⅜" draw.

HENRY & WRIGHT MFG. CO., Hartford, Conn.

Dieing Machines—Steel Presses
Stock Reels—Roll Straighteners
Sensitive Drilling Machines

Performing ALL stamping operations at speeds up to 600 strokes per minute.



Made in capacities of 10 tons to 300 tons. Produce 1 to 20 COMPLETED stampings at each stroke. Precision of product can be maintained to .0002". Saves on single-station die operation, as well as progressive. Superior smoothness permits new high speeds, up to 600 s.p.m.

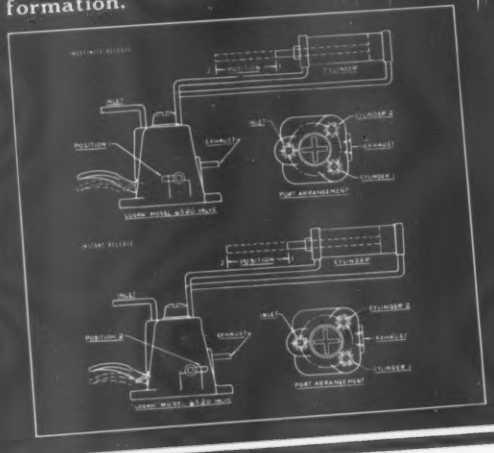
REQUEST CATALOG 40

BLANKING—PIERCING—DRAWING—FORMING—COINING—EXTRUDING

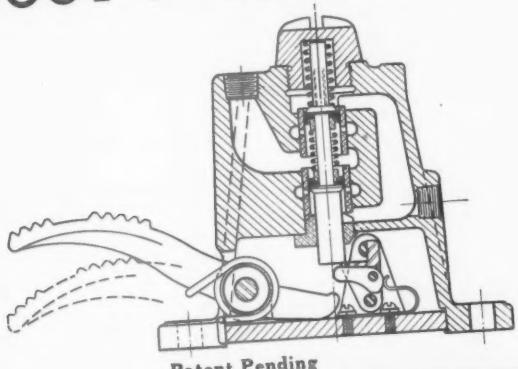
A NEW DUAL PURPOSE AIR CONTROL VALVE

CONVERTABLE TO INSTANT OR INDEFINITE RELEASE TYPES . . . . . .

"Logan" Engineers realized the necessity of developing a Dual Purpose, Foot Operated, Four Way Control Valve and now present to you the Model 6520 valve. This type valve gives instant or indefinite release control over cylinders. A convenient latch lever on the valve side is operated from one position to the other for changing the valve functions. This type valve permits standardization of valve equipment in your plants. Adopt this type valve for your needs and benefit by the outstanding design features offered: Simplicity of construction, ease of operation, long life, and trouble free service. Valve is self cleaning, moulded cup packings are self sealing and all parts are corrosion resistant. Write for complete information.



MODEL 6520
FOOT OPERATED



Patent Pending

"LOGAN"

LOGANSPORT MACHINE, INCORPORATED
902 Payson Road LOGANSPORT, IND.
Manufacturers of Air and Hydraulic Devices, Chucks, Cylinders, Valves, Presses and Accessories

LOOKING AROUND

By Perry Scope

Designing comfortable tools — we decided meant designing tools "which give entire satisfaction." So when we come right down to it fellows, it means that a tool designed by you should carry a guarantee on your design, a guarantee to "deliver the goods satisfactorily." You know all you have to do is design a few like that and when the boss sees your signature in the right hand corner of the prints or tracings there will be fewer changes called for and even less questions asked. When I'm told to put a certain movie on my "must see" list the first question I ask is not "who are in the cast?" That's secondary; but who produced and directed it? When you tell me that a certain new product is the result of Norman Bel Geddes work I know it will sell even if I don't like it; but better than that, you can produce it with modern methods as cheaply as possible.

No small wonder then that you must be informed of Industry's ever-changing needs, and hence ever-changing materials and supplies. And because of this constantly seething sea of change keep yourself flexible, moving about in it so you can keep your head above water. Don't allow yourself to become fixed by habit, or you will drown unnoticed. Then when you meet a new idea you will be able to better accept or deny its value to you and your work. But please for you own sake if not for your boss' or customer's, please meet suggested change with a welcome friendly attitude. Even that "dumb salesman" who calls on you may drop a worth while idea once in a while. Once in a while you have to put 2 and 2 together to get 22. Then it's the jack-pot.

In other words, be alert to pick up ideas anywhere, anytime, provided it will make you and your work more practical. You might even attend the A.S.T.E. meetings more regularly, and not allow yourself to get side tracked behind some cocktail. A good meeting gives satisfaction too. In fact—it may help "deliver the goods satisfactorily" and comfortably. And I'm for anything that will promote more practical, comfortable tools.

Before you so eagerly put your signature on that last design—that masterpiece of ingenuity—answer these questions:

1. Who uses this tool — Man or Woman: Skilled or Unskilled?

a. Will it weigh too much, too little? Too complicated? Fool proof?

2. Are there correct facilities to handle it?

a. Crane facilities, trucking, swing, throat, storage? You must plan for economic handling of tools and materials —Yes, that's your job too, unless your plant provides another man for just such work; even then cooperate with him.

3. Will it be in a comfortable position when at work? You don't know— D—n it, you better find out.

4. Have you made it rigid?

5. Will it bottom properly without rocking?

6. Will it be at the right angle for approach to the work? Fatigue to operator? What do you mean? "That's for the motion study department." How are they going to change it after that clumsy tool or fixture you've designed is made?

7. What about putting in some tool setting spots, for set-up, Boy! how the operator will bless you if you do.

Do you ever walk down into the shop and ask an operator who doesn't know you designed it, how he likes that tool or fixture he's using. If he says N.G., find out exactly what he thinks is wrong. Go back to your board and think it over—maybe he was right. Yes Sir, when you start designing a practical, comfortable tool you go through a lot of discomfort in the process, before it gives entire satisfaction.

Perry Scope

Get your copy of the complete transactions of the recent National Annual Meeting of the American Society of Tool Engineers. More than thirty authoritative papers.

For the average job one of the many standard sizes and types of Ross valves will exactly fit every requirement. If, as in the case illustrated above, you have one of those out-of-the-ordinary or hard-to-lick problems, simply call for a Ross engineer to help you. Always . . . Ross air valves offer maximum service, dependable operation and long life.

ROSS Air Control VALVES

THE BRIDLE FOR AIR HORSEPOWER

Send for Catalog

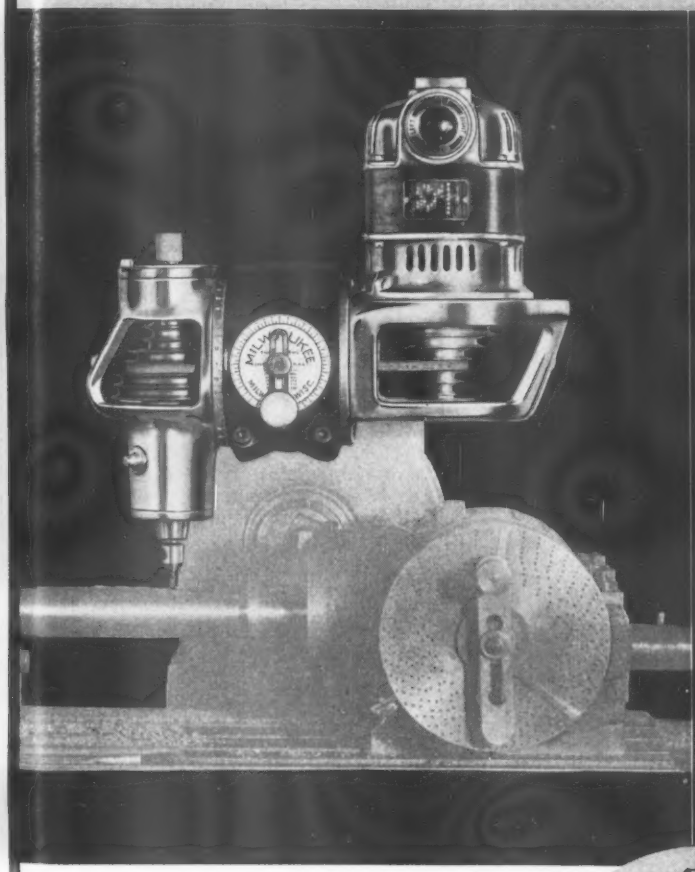
ROSS Operating VALVE CO.
6492 Epworth Boulevard
DETROIT, MICHIGAN

ANNOUNCEMENT...

The Midgetmill and Speedmill, high-speed milling attachments formerly produced and sold under the name of DALRAE by the DALRAE TOOLS CO., Syracuse, New York, are now part of the K&T Milwaukee line of modern milling machine attachments and accessories.

The efficient design and high quality of construction of both the Midgetmill and the Speedmill will be maintained — in keeping with the accepted and recognized K&T Milwaukee Milling Machine standards of performance and quality.

KEARNEY & TRECKER CORPORATION
MILWAUKEE, WISCONSIN, U.S.A.



The SPEEDMILL

— For accurate end mill speeds up to 3200 r.p.m. Easy to operate, furnishes closer sizes and improved finishes. A profit-producing tool, adapted to all types of milling machines.

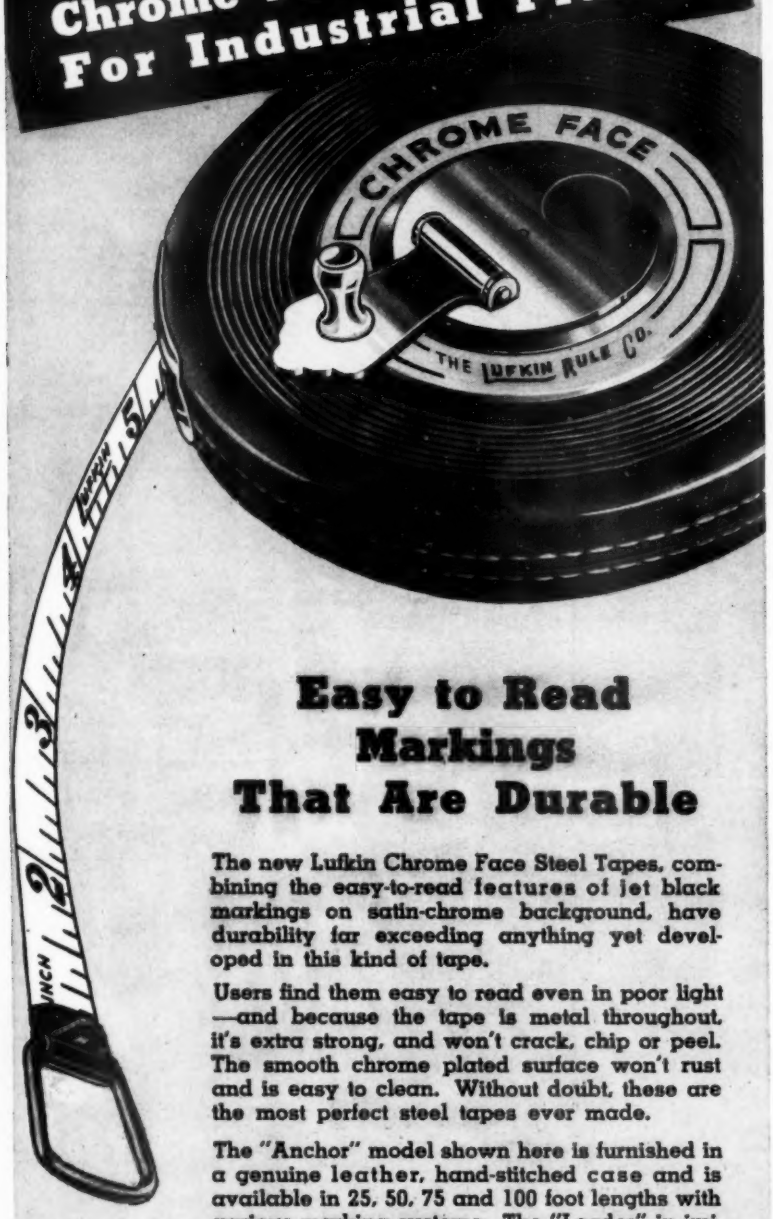
K&T

The MIDGETMILL

— Designed to get the most from small tools by providing the necessary high speeds. Equipped with the "Thou-Meter" giving a continuous reading in thousands at which the tool is operating. Completely universal—adaptable to any milling machine—fast, safe and easy to set up.

MILWAUKEE MILLING MACHINES

LUFKIN
Chrome Face Steel Tapes
For Industrial Plants



Easy to Read
Markings
That Are Durable

The new Lufkin Chrome Face Steel Tapes, combining the easy-to-read features of jet black markings on satin-chrome background, have durability far exceeding anything yet developed in this kind of tape.

Users find them easy to read even in poor light—and because the tape is metal throughout, it's extra strong, and won't crack, chip or peel. The smooth chrome plated surface won't rust and is easy to clean. Without doubt, these are the most perfect steel tapes ever made.

The "Anchor" model shown here is furnished in a genuine leather, hand-stitched case and is available in 25, 50, 75 and 100 foot lengths with various marking systems. The "Leader," in imitation leather case retails at popular prices.

Write for Circular
and Free Sample Section of Tape

BUY THROUGH YOUR DISTRIBUTOR

NEW YORK
106 Lafayette St
THE LUFKIN RULE CO
SAGINAW, MICHIGAN
Canadian Factory
WINDSOR, ONT

TAPES — RULES — PRECISION TOOLS

(Continued from Page 62)

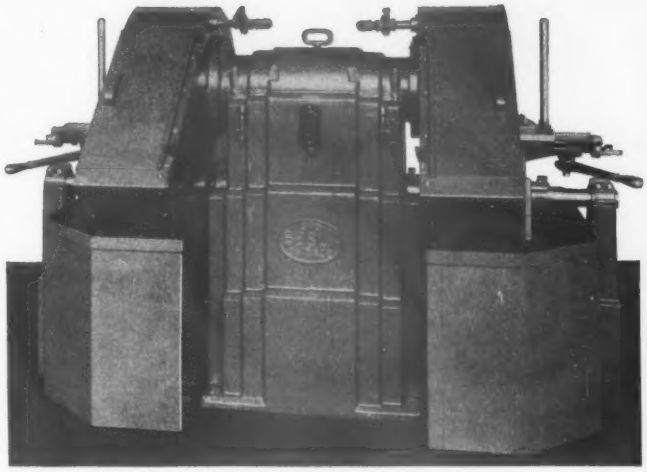
out, machine tool layout, time study, cost analysis, cost reduction, and management. Many engineering colleges already offer most of these in elementary form as optional courses in mechanical or industrial engineering.

Industry would be eager to help by supplying practical information for such courses. It might even be possible that industry could give students concrete, everyday problems in tooling gasoline engines, refrigerators, electric motors, or any of the other multitude of products of American factories. Undoubtedly such problems would help the student, and it is probable that industry itself might benefit from the criticisms or creative ideas of students. Students of Tool Engineering, of course, should be given as much practical experience as possible in the operation of machine tools and in designing, constructing, and using jigs and fixtures. In fact, students should be able to produce many of the things normally purchased by their universities and colleges. Probably they could build some of their own machine tools, make their own jigs and fixtures; and undoubtedly they could make many personal tools, such as calipers, gauges, etc. I believe also that a great deal of the repair work could be done advantageously by students, to give them some idea of how plants and machines are maintained in practice. Industry, I know, would be glad to assist these young fellows financially by giving them jobs in the shop during summer vacations.

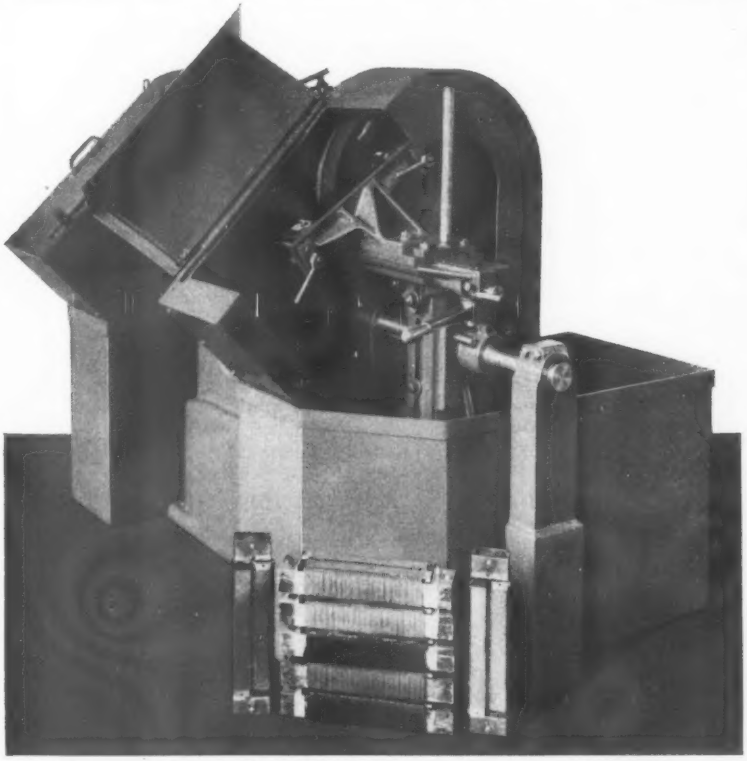
I have discussed in some detail my ideas of how educational agencies could assist youth, because I feel that this is one of the most important jumps we can take, if we are to get ourselves out of the rain barrel. I believe the legislative and regulatory bodies of our country also need to take stock and see whether they have not overplayed some of their political cards to a damaging extent. Some of our labor laws, passed with the intention of correcting unfair practices, in many instances have succeeded only in aggravating a bad situation. Laws in several states make it illegal for industries to employ a boy until he is 18 years old. These laws were partly intended to abet the acute employment problem by throwing all possible jobs open to the needy, and partly to check unfair labor practices; however, I feel that our legislators were somewhat short-sighted in failing to consider what effect this would have on young people. I believe every ambitious youngster wants to do something constructive as early as 14 or 15 years of age. Many of today's most successful business men started when they were even younger. Most of them refer to these formative years as the period during which they acquired habits of hard work and straight thinking that helped

(Continued on Page 70)

The Unusual BESLY GRINDER JOB



Illustrations show #210-18"-L Besly Wet Grinder especially equipped for grinding coils for electrical control. Operation consists of grinding enough Bakelite, cotton covering, insulating varnish and copper wire so as to properly expose the contact surface. • Not so unusual for Besly who in the last fifty years have furnished machines for grinding (in addition to most known metals) such materials as cork, rubber, terra cotta, fibre, catalin, Bakelite, refractories, glass, pottery, porcelain, building brick, ivory, paper, quarry and floor tile, etc. • Take advantage of this well rounded experience and put your flat surfacing-problems up to us. • Our knowledge gained through almost fifty years of Besly grinding is yours for the asking.



Note the efficient Water Hoods that properly confine the coolant.

Write for your copy of Booklet on Besly Titan Steelbacs.

CHARLES H. BESLY AND COMPANY

118-124 NORTH CLINTON STREET ★ CHICAGO, ILLINOIS

TRY THEM!
FREE SAMPLES
BRISTO SOCKET SCREWS

Convince yourself that Bristo's faster, easier, tighter set-up means speedier assembly, stronger construction, minimum assembly cost. All you have to do to get Bristo Socket Screws for an "on-the-job" try-out, is to mail in the handy coupon below. It brings you a tidy selection of Bristo Screws and Wrenches for you to set up—either on your products or your production machinery.

BRISTO'S THE CHOICE . . . *for good reasons!*

These easy-to-handle socket screws set up tighter, and with less effort. And they stay tight, too,—holding with a grip that defies vibrations. The exclusive fluted design of the socket head permits greater force without weakening, without danger of stripping or rounding out. Time and again a Bristo can be backed off and retightened without damage to the socket. Use of a Bristo reduces necessity of frequent replacements. Assembly time is saved. No wonder so many manufacturers have standardized on Bristos!!

MAIL THIS COUPON!

Free Bristo samples, and Bulletin 838V which gives you facts on these labor-saving screws, are ready for you. Send for both today. The Bristol Company, Mill Supplies Division, Waterbury, Conn.

QUICK BRISTO FACTS

Lock-tight socket head, won't split, shear, round out, jam or strip . . . Set tighter with less effort. . . . No loosening under vibration. Take wrench without fumbling . . . or skidding.

BRISTO
SOCKET SCREWS

THE BRISTOL COMPANY, Mill Supplies Division
Waterbury, Conn.

Send me sample Bristo Socket Screws and Bulletin 838V.

Name_____

Address_____

PRODUCTION PERSPECTIVES

(Continued from Page 36)

S. Levenson, who said **material** would be **obtained from automobile graveyards throughout the state.**

Marked **improvement in employment conditions in New Hampshire** during **1939, culminating in a September figure which marks the peak of New Hampshire employment in recent years,** are **indicated in a statistical analysis** made public **by the New Hampshire Bureau of Labor.** The report, compiled by William J. Roy, chief statistician of the Unemployment totals compiled during the last two years, and yields, according to Mr. Roy "an accurate picture of business trends in New Hampshire."

The Phillips-Fairbanks Company, Inc., newest industry in New Hampshire, **will begin production of wire and cable reels** within a few weeks officials have announced. The **concern will manufacture one-time reels of 36 inches maximum size.** The **reels will be used for electrical or communication wire transportation,** and will be discarded when empty. **Wallace Phillips, one of the partners was employed by the Proctor Reel Shop in Ashuelot** for seven years **until fire destroyed that plant recently.**

Payroll disbursements to Rhode Island workers amounted to $15,686,954 during the **four weeks ended Feb. 24,** an **increase of 9.3 per cent from January** and a **gain of 5.0 per cent from February, 1939,** according to figures released by the Federal Reserve Bank. **February's payroll volume was only 1 per cent under the $15,849,865 reported for February, 1937,** the largest February total in the past 10 years. Payrolls of workers in manufacturing plants increased 8.2 per cent from January and those of non-manufacturing employes advanced 11.5 per cent. With the exception of non-ferrous metal trades, all manufacturing industries reported larger payrolls volumes in February than in the preceding month.

West

Terming the forecast of increased business for 1940 by Col. Leonard P. Ayres, famed Cleveland economist and statistician, as **"sound because it is documentary," Dr. Paul F. Cadman, president of the American Research Foundation in San Francisco, recently declared that there are great opportunities ahead for industry.** Here to address the local chapter of the American Institute of Banking, Dr. Cadman said there are great things ahead. **"I am extremely hopeful," said Dr. Cadman. "I do not belong to the defeatist group. If this economic system of ours does not take up present opportunities we might as well admit we're licked."**

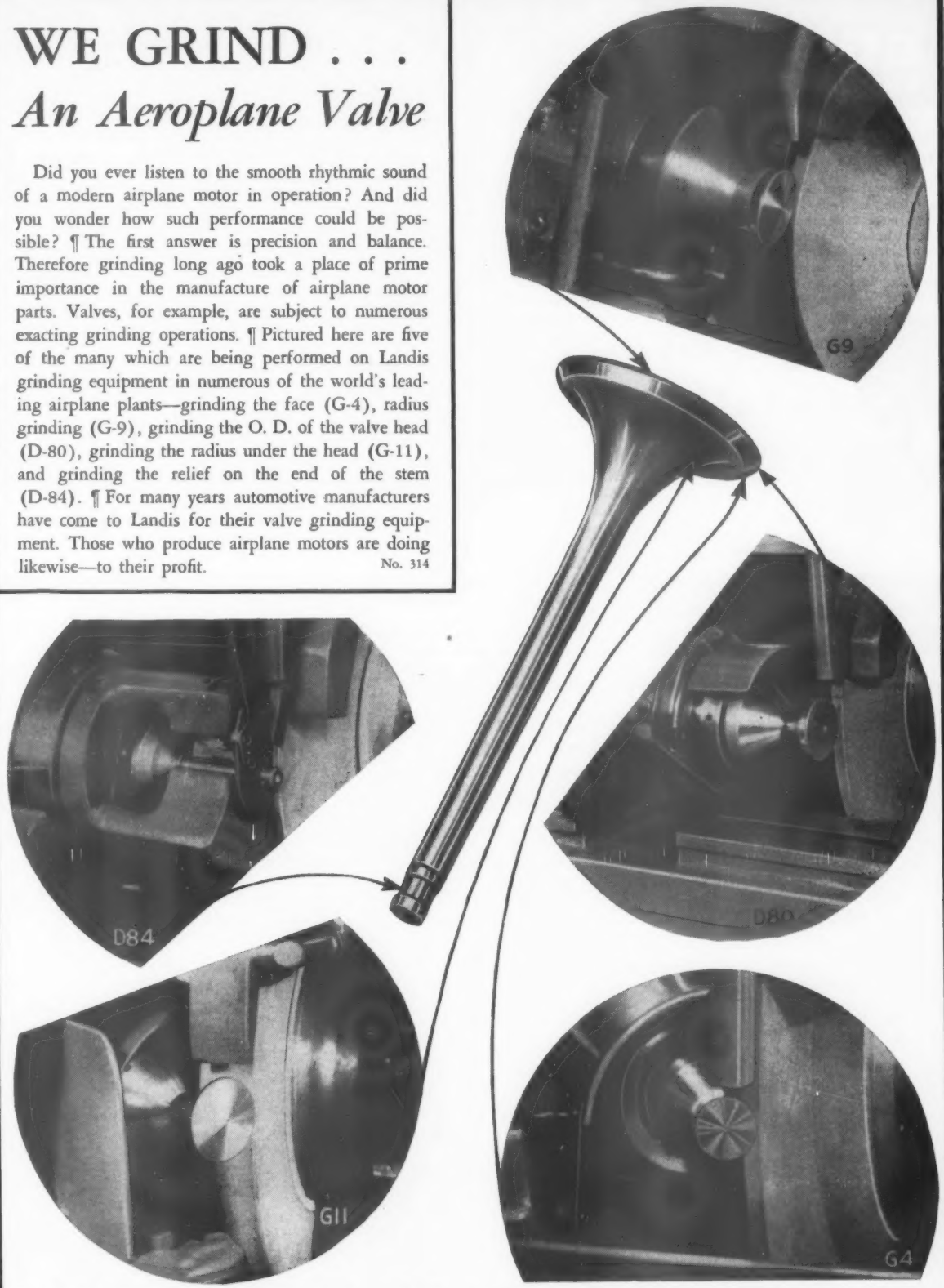
South

January broke three records in Dallas' industrial expansion program. The **new records established** in the first month of 1940 **were** for the **number of businesses located in Dallas,** the **number of new manufacturing plants secured** and the **number of branches of national concerns established in this growing Texas city.** January industrial developments were indicative of a trend which is continuing this month, with prospects of making 1940 a record-breaking year in the history of Dallas' industrial growth. There were **133 new businesses established in Dallas during January.** The month's acquisitions included nineteen manufacturing plants and sixteen branches of national concerns. **The month also brought Dallas twenty-eight new wholesale establishments, six oil companies, forty-two retail concerns and thirty-eight classified as miscellaneous.**

Plans for **construction in Argentina of an automobile factory to cost approximately 6,000,000 pesos ($1,410,000)** were **announced by Graeme Howard,** general manager of **General Motors Corp.** It was understood the **factory** would **begin operation in 1942.**

WE GRIND . . .
An Aeroplane Valve

Did you ever listen to the smooth rhythmic sound of a modern airplane motor in operation? And did you wonder how such performance could be possible? ¶ The first answer is precision and balance. Therefore grinding long ago took a place of prime importance in the manufacture of airplane motor parts. Valves, for example, are subject to numerous exacting grinding operations. ¶ Pictured here are five of the many which are being performed on Landis grinding equipment in numerous of the world's leading airplane plants—grinding the face (G-4), radius grinding (G-9), grinding the O. D. of the valve head (D-80), grinding the radius under the head (G-11), and grinding the relief on the end of the stem (D-84). ¶ For many years automotive manufacturers have come to Landis for their valve grinding equipment. Those who produce airplane motors are doing likewise—to their profit. No. 314

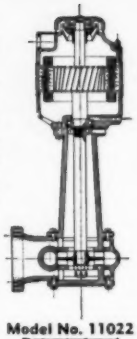


LANDIS TOOL CO. WAYNESBORO, PA.

RUTHMAN
GUSHER
COOLANT PUMPS

TODAY'S PUMP FOR TOMORROW'S MACHINES

The present trend is to simplify machine tools, to make them more compact and in reality beautify them. Ruthman pipeless Gushers make it easy for the designer to do this. Models up to 200 G.P.M.



Model No. 11022
Patented and Patents Pending

Model No. 11020A

Gushers are easily mounted, ball-bearing equipped, hydrostatically balanced, self-cleaning, and grit and abrasives pass through them easily. Write for engineering data and specifications.

THE RUTHMAN MACHINERY CO.
542 E. FRONT ST., CINCINNATI, OHIO
LARGEST EXCLUSIVE BUILDERS OF COOLANT PUMPS

OUR SOCIETY AND INDUSTRY

(Continued from Page 66)

them tremendously in later years.

Many of you undoubtedly served your apprenticeship as machinists or tool makers, and I venture to say that you keep tucked away somewhere among your prized possessions perhaps a metal cube, filed accurately to a given dimension—or maybe its a set of calipers or some jacks. And you'll tell me confidentially that you made them when you were a mere lad of 16—and that they were far better than anything you could buy at the time. Young men of today would like to do the same things—to indulge their creative instincts—but our educational and industrial systems and our laws prevent them from doing so.

We all know that some individual industries took ruthless advantage of youth by paying low wages for long hours under poor working conditions. But why restrict young people in their natural tendencies, in order to clean up a relatively small number of dirty industrial spots? Why not smear the individual offenders, and let the fair-minded majority extend a hand to aspiring youth?

Unless industry becomes interested in a program to bring more young blood into its manufacturing establishments, business itself will deteriorate, because as men grow older their ideas become more conservative. As new and difficult problems arise, older men lean on past experience and tradition, and know for sure that certain things can't be done. But the aggressive young fellow never heard about these impossible things—so he does them. Youth provides incentive to all industry.

I have devoted a good deal of time in showing just how formidable are the problems that confront our society and our industry. Even so, perhaps I have even understated their seriousness, because unless something is done to solve them pretty shortly, they constitute a threat to the very existence of the machine, to industry as a whole, and even to our national economy.

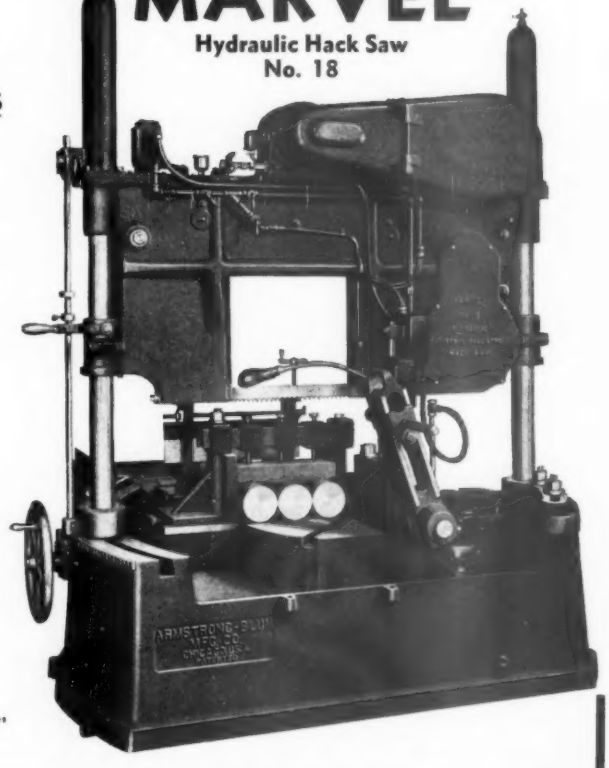
What can you and I do? Well, first of all, let's not be mud slingers! There's entirely too much brick-passing these days—government blames industry, industry blames labor, and labor factions blame each other. Let's assume that we are partly at fault for the general muddle—then let's go out and do a job of selling our honest convictions.

Our first big selling job is to convince youth that industry wants them, needs them—as it surely does. This will have to be accomplished slowly. We must start with our own children and their children, to convince them that the lot of the maker of the products of commerce is as honorable and desirable as that of the man who sells them. We must strike at white-collar snobbery.

(Continued on Page 74)

A GIANT IN CAPACITY
IN RUGGEDNESS
IN POWER
IN PROPORTIONS

MARVEL
Hydraulic Hack Saw
No. 18

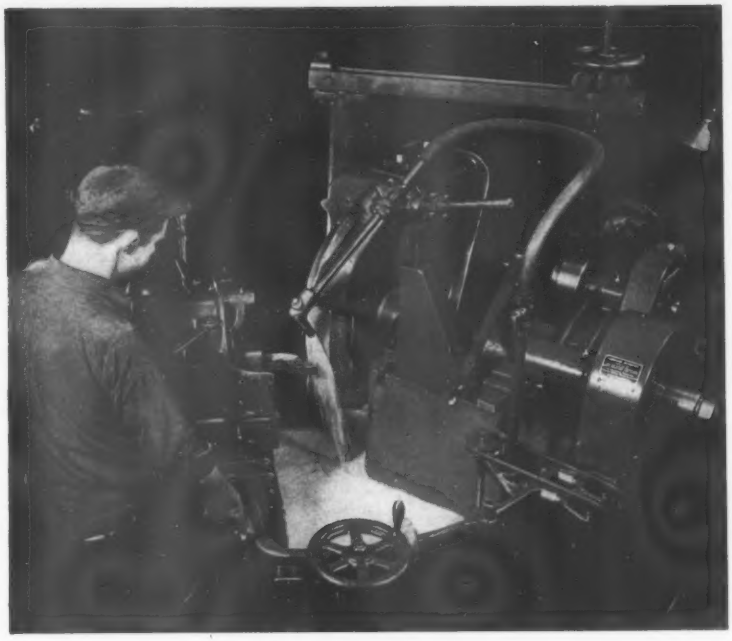


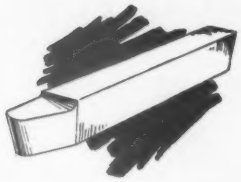
• Here is a new giant hack saw for doing a giant's work—the MARVEL No. 18. Swing an 18" x 18" billet or bar of the toughest steel into the MARVEL No. 18 and under its smooth hydraulic feed, its chip-clearing roll-stroke action, it will cut it down with unbelievable ease and speed.

• Here is a saw that takes "all comers" and will stand up to continuous operation on the heaviest work. Armored, with all moving parts protected, it is not endangered by the thumps and knocks incidental to handling large work. It is a tough powerful unit, yet handles like a baby with its trouble-free, low pressure hydraulic feed and quick traverse. For large sizes and tough steel it is unequalled in speed, accuracy and economy.

• Write for full information.

ARMSTRONG-BLUM MFG. CO. "The Hack Saw People"
5750 Bloomingdale Ave., Chicago, U.S.A. Eastern Sales:
199 Lafayette St., New York



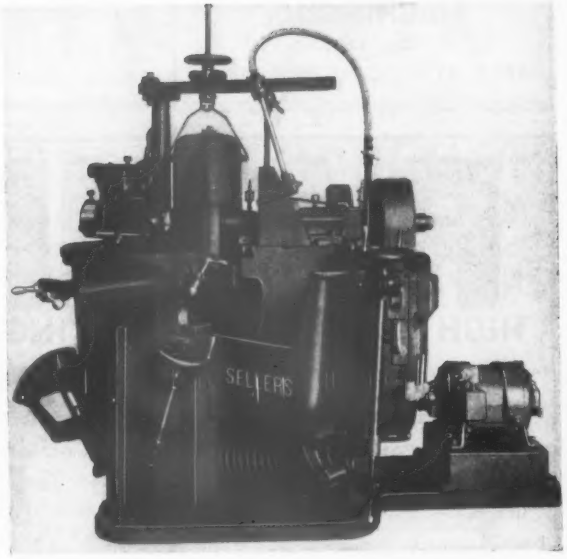


How your tool room attendant can step up production

IN THESE DAYS every productive employee counts — but only while on productive work. Do you know how much of your machinists' time is spent on tool grinding? The figures may surprise you.

Why continue? An expensive machine stands idle . . . production is held up! Yet your tool room attendant can do this job. With a Sellers Tool Grinder, he can grind tools more accurately than the best machinist can by hand . . . and in less time. Less tool steel will be wasted and the tools will last longer and cut better. Your machinist can be kept on the work you are paying him to do — and production will not lag.

If you are looking for a way to save money and keep production at peak, we know you will want more information about Sellers Tool Grinders. Write today.



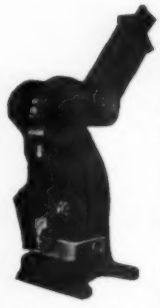
WILLIAM SELLERS & CO. Incorporated
1626 Hamilton St. - - - Philadelphia, Pa.

FOUNDED SELLERS 1848

Sellers

T. H. L. FRONT LEVER

BENCH PUNCH



Built for hard, tough work—die cannot lose alignment with punch—all parts interchangeable.

Capacity ½" holes through $\frac{3}{16}$" steel; $\frac{13}{32}$" through ¼" steel. Can also be made for holes up to ⅞" in thinner metal. Stock punches and dies available from $\frac{1}{16}$ to ½" by 64ths.

Weight, 70 lbs.

PRICE WITH ONE PUNCH AND ONE DIE—

$37.00

Immediate Shipment

T. H. LEWTHWAITE MACHINE CO.

(Est. 1890)

307 E. 47 St. NEW YORK

PRODUCTION PLANNING

(Continued from Page 12)

ance should be pleasing in appearance, free from burrs which may cause injury or damage, free from dents and scratches, rough surfaces, rounded corners on nuts and broken out screw slots. It should be easy to service so that worn parts can be replaced with new parts that fit. Rotating apparatus such as generators, motors, etc., should be free from excessive strains or notches which may cause failure and the like.

It might appear that some of these items are entirely within the control of the product engineer and inspector. However, it is not always easy for the design engineer to cover completely all of these details by drawing and specifications, and it is also hard for the inspector to control them. They must be planned, tooled, and supervised into the product. Much of this can be accomplished with little, or no, extra cost, and sometimes even with a reduction in cost.

In the manufacture of new products in which developmental changes are rapid, such as in the earlier type radio receivers, tools should be constructed as flexible as possible.

Better working conditions in the shop are now of vital necessity. The safety of operators, unnecessary manual effort and noise, convenience, good visibility and ease of training new help, all must be considered when the tooling is planned.

I certainly appreciate the opportunity of addressing the opening session of this convention, and hope that the various technical meetings which are to follow, will result in mutual benefits to all from the many discussions and interchange of ideas between Tool Engineers representing so many lines of endeavor. Also, that these sessions will point out the importance of proper planning and show how the Tool Engineer is the person best qualified to control it.

TOOLING LARGE PRODUCTS

(Continued from Page 50)

together with the operation planning supplied by the application planners to ship a quality product, one that has cost us the least amount of money, in the shortest possible time.

In other words, gentlemen, our formula, if it may be called such, is knowledge tempered with good judgment. To apply it effectively and efficiently

1. The Tool Engineer is in intimate contact with the design while on the drafting board and working in conjunction with the design group and supervision decides on tool requirements. This we call pre-planning.
2. Tool information as supplied by the Tool Engineer is interpreted into terms of operation planning by our Planning Department. This we call application planning.
3. The foremen use the tools and the information supplied to process our apparatus. This we call intelligent supervision.

Reduced to words of few syllables we handle our tooling problems on this type of apparatus by:—

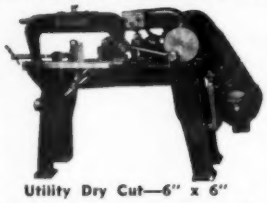
1. Comprehensive pre-planning.
2. Adequate application planning.
3. Good intelligent supervision.

RACINE

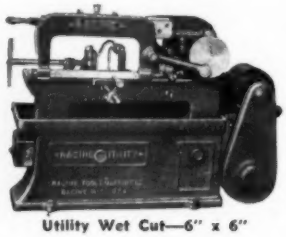
HIGH SPEED METAL CUTTING MACHINES

HYDRAULIC UTILITY SAWS

Here are moderately priced saws designed to handle your general shop cutting in the most efficient and fastest manner. These Utility saws contain those advantages of Hydraulic feed and control formerly found only in expensive production machine tools.



Utility Dry Cut—6" x 6"



Utility Wet Cut—6" x 6"

Hydraulic operation reduces moving parts to a minimum — No friction drives, ratchets, or screws to wear or cause horsepower loss. RACINE Utility saws prolong blade life because of their smooth oil-cushioned operation. Their sturdy, rugged construction gives you the fastest, most accurate cutting with the least cost.

Available in two types—the Wet Cut Model and the Dry Cut Model—6" x 6" capacity.

Tear out the attached coupon and get our free catalog No. 70A. You will be surprised to learn of the savings to be made using these modern RACINE machines.

"Let RACINE Engineer Your Metal Cutting Problems"

The most complete line with
RACINE Heavy Duty Hydraulic Saws 10 x 10 to 14 x 20
RACINE "Shear Cut" Screw Feed Saws 6 x 6 to 8 x 9
RACINE Hydraulic "Oil Cut" 6 x 6
RACINE Utility Saws 6 x 6 and Racine Duplex Bandsaws

"STANDARD THE WORLD OVER"

RACINE TOOL & MACHINE CO.
1777 State St., Racine, Wis.

RACINE TOOL & MACHINE CO.
1777 State St., Racine, Wis.

Please send me catalog No. 70A on RACINE Utility Saws. ☐ Also general catalog on complete line.

Name .....
Company .....
Street .....
City ..... State .....

TOOLING SMALL PRODUCTS

(Continued from Page 56)

of new processes which will result in the tool designer being given another chance to see what he can do with the mechanical side of production.

As I told you in the beginning, the plan as outlined is not actually in effect although it is our hope that it will constitute an acceptable contribution to the efforts of your Society to reduce the problem of economic tooling to formula.

VISUAL MACHINE FINISH

(Continued from Page 60)

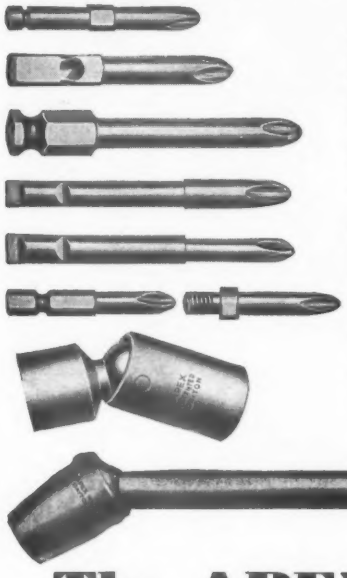
acteristic "f" finish mark is used with a number underneath indicating the finish specification. For ground surfaces a capital "G" is used likewise with a suitable number underneath.

The system in use only covers turned and ground surfaces. To include planed and milled surfaces the same general procedure would be followed with warranted changes in feed per revolution or feed per stroke and tool characteristic values. The setup is as

(Continued on Page 80)

APEX PRODUCTION TOOLS

Aircraft . . . Automotive . . . Manufacturing



Apex-Phillips Power Bits, for all electric, air and spiral drivers, are made from special shock-resisting steel, heat-treated and tempered to give maximum hardness, toughness and wear resistance.

Apex Power Bits for Slotted Head screws, for all electric, air and spiral drivers, range in size from No. 4 to No. 18 screws.

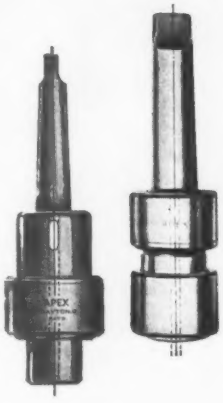
Apex Universal Joints have no projecting ears, screws or sharp corners to catch; can't overtravel their working angle of 35° and lock; are durable and smooth running.

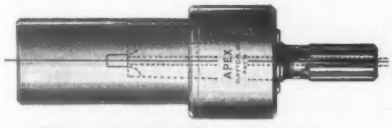
Apex Universal Socket Wrenches are available for all kinds of speed braces and extension shanks.

Apex Safety Friction Chucks maintain their friction setting... are not affected by end thrust ... can be used in any position ... tools can be changed while machine is running ... chuck slips before breaking tool—these features save time and money.

Apex Floating Tool Holders make possible accurately reamed and tapped holes on any type equipment ... amount of float varies from a few thousands to ⅛"... with Quick Change Drill collet, tools for series of operations can be changed without slowing down the machine ... available in Extended Socket and Short Nose types for Morse Taper or straight shank tools.

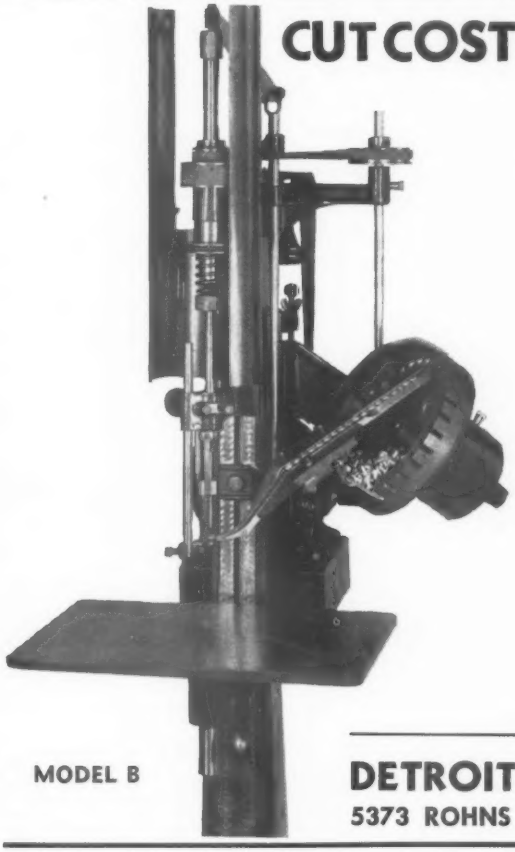
Apex Vertical Float Tapping Chucks are used for multiple tapping. Vertical float permits each tap to enter free and tap its hole true to size. Used for power feed, lead screw or hand feed tapping. Same collets and tools as Friction Chucks.





The APEX MACHINE & TOOL Co.

505 East Third St. Dayton, Ohio



MODEL B

CUT COSTS - INCREASE PRODUCTION

with

DETROIT POWER SCREWDRIVERS

These Magazine Feed Power Screwdrivers Drive Screws Faster Than Ever Before

Machine screws, wood screws, brass screws, aluminum screws, self-tapping screws, drive screws, cap screws, special screws, washer assembled screws.

Standard heads, special heads, Phillips heads, slotless heads.

Three Models Available

which provides handling a wide range of screw sizes. From a No. 2-56 screw to a ⅝" cap screw.

UNIFORM TENSION—NO MARRING OF HEADS

No stripping of threads.

DRIVING TIME: 1 to 2 seconds per screw.

SEND SAMPLES FOR PRODUCTION ESTIMATES

DETROIT POWER SCREWDRIVER COMPANY

5373 ROHNS AVENUE DETROIT, MICHIGAN

5 WAYS TO CUT DRAFTING TIME and EXPENSE

- Here's how OZALID TRANSPARENT papers, cloths, and foils provide short cuts in drafting practice and reduce costs.

1. DUPLICATE ORIGINALS ON TRANSPARENT PAPER, CLOTH OR FOIL FOR BRANCHES OR CUSTOMERS . . . made in the same simple manner as standard Ozalid Whiteprints.
2. TRANSPARENT DUPLICATES WITH CHANGES FOR SPECIAL PURPOSES WITHOUT ALTERING ORIGINAL DRAWING . . . produced by deleting detail and making additions on the duplicate. Standard Ozalid Whiteprints incorporating these changes are made from these transparent duplicates.
3. OLD, SOILED OR WORN TRACINGS . . . reclaimed and weak pencil lines intensified with Ozalid foil which can be cleaned to eliminate spots, blotches and crease marks.
4. COMPOSITE PRINTS . . . accomplished by bringing the details of as many as six originals together into one Ozalid Whiteprint by the use of Ozalid foil.
5. WHITEPRINTS . . . made from inexpensive Ozalid transparent duplicates, while valuable originals are stored safe from fire, wear, and tear.

ONLY OZALID HAS DRY DEVELOPMENT

Ozalid CORPORATION
ANSCO ROAD · JOHNSON CITY, N. Y.

OZALID CORP. 48-4
Ansco Road, Johnson City, N. Y.
Please send full information on how Ozalid transparent materials cut drafting costs, and free booklet of dry-developed Ozalid prints.
Name_____
Company_____
Street_____
City_____ State_____

(Continued from Page 70)

Our greatest ally in this, and in the subsequent task of molding youth to take over the huge problems of industry, is the public school. Let's not sit back and wait until educators come to us for help. Let's go to educational authorities in our own cities and states and help them to establish new courses of instruction to fit our young people for useful careers after graduation from high school. Then let's go to our colleges and universities not merely to suggest courses in Tool Engineering, but to offer our co-operation in establishing them and making them function.

Once we have geared educational machines to turn out graduates of the right caliber, our problem of securing more equitable legislation for young workers becomes greatly simplified, because young people, their parents, and industry will unite to put pressure on legislatures and other restrictive agencies.

I am convinced that these actions to help youth are among the most important projects which we, collectively as a society and individually as representatives of many industries, should attack. When older people look into the future and behold only futility, its sericusness is not likely to be of long standing, lamentable though it may be. But when young people look frustration in the face consistently, youthful impetuousness and resentment resort to drastic measures, and they turn to any means of smashing the forces that restrain them. We know what the means will be, unless we act. Already the siren voices of incipient dictatorships entice our youth. The way to thwart these subversive influences is to give youth incentive, show the advantages of the American way.

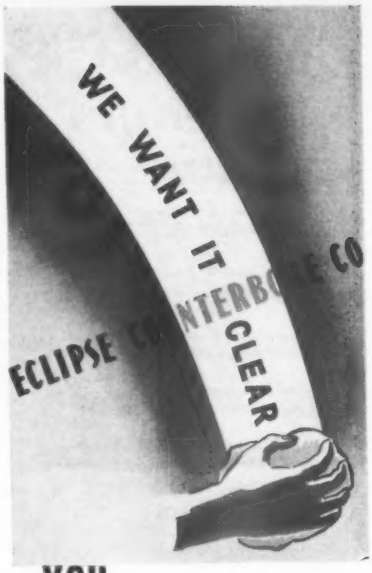
This, I say, is one of our biggest jobs.

Finally, let us not lose our faith in the machine. Invention, improvement, and the use of better tools and machines are the real creators of time savings. And only through making time savings, can we increase everyone's share of the national income by making it larger. There cannot be anything basically wrong with the use of improved machinery when it has increased our national income by 30 billion dollars during the last three decades and has given us the highest standard of living of any country on the face of the earth.

Any agency that reduces or nullifies the creation of new machine-made time savings will condemn us to progressively less and less consuming power, fewer and fewer jobs, and shrinking wages.

Machines create time savings—time savings create national income—national income creates purchasing power—purchasing power creates jobs and wages.

The machine will do a job for us. Let's give it the opportunity!



YOU CAN GET ECLIPSE QUALITY IN ANY OF THESE TOOLS

- ★ MIKROLOK PRECISION BORING AND REAMING BARS
- ★ INTERCHANGEABLE QUICK DETACHABLE COUNTERBORES
- ★ TWO PIECE CORE DRILLS
- ★ MULTI-DIAMETER CUTTERS
- ★ BALANCED DRIVE BACK SPOT FACERS

CATALOG 35 DESCRIBES THEM ALL — WRITE FOR IT TODAY

ECLIPSE COUNTERBORE COMPANY
DETROIT · MICHIGAN

Mention "The Tool Engineer" to advertisers

Send for this Valuable Book

FORGINGS

SMOOTH HAMMERED

HYDRAULICALLY PRESSED

MACHINED AND HEAT TREATED

COMPOSITE DIE SECTIONS

TOOL STEEL AND ALLOY STEEL

ALL GRADES

FOR ALL INDUSTRIES

AJAX STEEL AND FORGE Co.

205 ADAIR STREET DETROIT, MICHIGAN

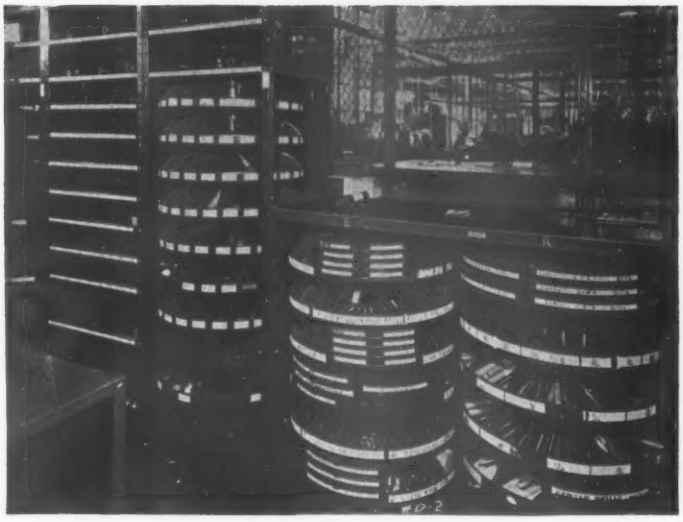
"ROTABIN"

—SPEEDS TOOL ROOM SERVICE

—SAVES TIME, MONEY AND SPACE

The "ALL-ROUND" Answer to parts storage problems.

Let "ROTABIN" solve the usual and unusual storage requirements. Let us survey and recommend the proper equipment for your needs. No cost — No obligation. Write today.

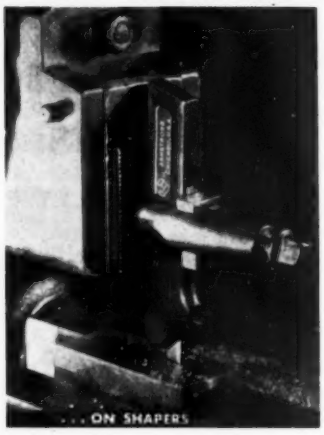


THE FRICK-GALLAGHER MFG. CO., WELLSTON, OHIO

ARMSTRONG

Keep Ahead of Competition With the Right

ARMSTRONG TOOL HOLDERS



Fifty years ago, the first users of ARMSTRONG TOOL HOLDERS had a tremendous advantage over their competitors. Others had to forge tools for every operation. The user of ARMSTRONG TOOL HOLDERS "Saved: All Forging, 70% Grinding, and 90% High Speed Steel."

Today with ARMSTRONG TOOL HOLDERS used in over 96% of the machine shops and tool rooms, those with a complete Armstrong System, Tool Holders for every operation on every lathe, planer, sloter and shaper have the big advantage. They are permanently tooled up and are ready to start work on any job on a moment's notice—have no special "tool costs," have no tooling-up time to absorb. They have the most efficient tool available every step of the way. They can safely run at faster speeds and feeds—at any speed the machine can pull. They will hold closer tolerances and lessen spoilage, will maintain schedules, will have no delays caused by tool failure or tool breakage.—

To keep ahead of competition, keep ahead in ARMSTRONG TOOL HOLDERS. You can build your Armstrong System a tool at a time from the stocks of your local Mill Supply House. Make it a standard "tool policy" to check in the ARMSTRONG Catalog for the correct tool holder before starting a new operation.

Buy ARMSTRONG TOOLS from your Supply House

ARMSTRONG BROS. TOOL CO.
"The Tool Holder People"
360 N. Francisco Ave., Chicago, U.S.A.
Eastern Warehouse and Sales Office:
199 Lafayette St., New York, N. Y.

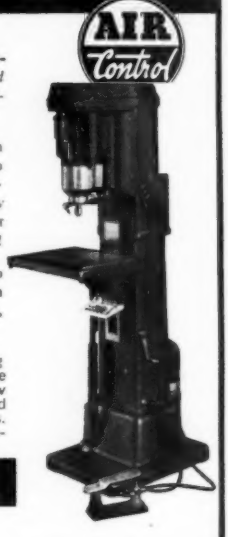
Again-YEARS AHEAD!

New Kind of Tapping Performance from New Kind of Tapper with Built-In Air Control!

Actual Tapping Operation Automatically Air Controlled. Same *cushioned* pressure stroke after stroke! Same *uniform* results at 4 P.M. as at 8 A.M.!

Operator Errors Minimized. Down stroke, return stroke and dwell at top of stroke easily adjusted to job and entirely controlled by air. Operator merely depresses foot pedal for continuous or single cycle operation and feeds machine!

Tap Breakage Sharply Decreased. Tap *can't* be crowded too far. Tap head action so sensitive that if tap dulls or loads, machine refuses to work.



SEND FOR FREE BOOKLET showing how new Haskins Type C Tapper brings new precision, new speed and low tapping costs. Available in three capacities.

HASKINS

R. G. HASKINS CO.
2756 W. Flournoy St., Chicago

CHAPTER MEETINGS

(Continued from Page 58)

Company of Detroit
Subject: "Modern Metal Cutting."
Speaker: Lester Detterbeck, President, The Banner Manufacturing Company of Chicago.
Subject: "Cam and Cam Design" with 16 mm movie of cam cutting.

E. J. Emmons of the Associated Factory Mutual Fire Insurance Company will give a talk and show a technical movie film covering scenes of fires and safety promotion.

ROCHESTER

April 10, 1940—7:45 P.M., Lower Strong Auditorium, U. of R., River Campus.
Speaker: Walter K. Bailey, Warner & Swasey Co.
Subject: "Telescopes and Turret Lathes."
Reservation required for dinner only.

SOUTH BEND

April 11, 1940—7:00 P.M., Hotel Elkhart.
Speaker: J. C. Cotner, Gen. Mgr. of the Logansport Machine, Inc.
Subject: "The Application of Hydraulic Equipment to Machine Tools."

ST. LOUIS

April 11, 1940—Melbourne Hotel.
Speaker: Mr. Emmons of Cleveland Twist Drill Co.
Subject: "The Molybdenum Tungsten High Speed Steels."

SYRACUSE

April 9, 1940—Dinner 6:30 P.M., Syracuse Industrial Club. Technical Session 8:00 P.M. Installation of newly elected chapter officers.
Speaker: Walter K. Bailey, Warner & Swasey Company, Cleveland.
Subject: "Telescopes and Turret Lathes."

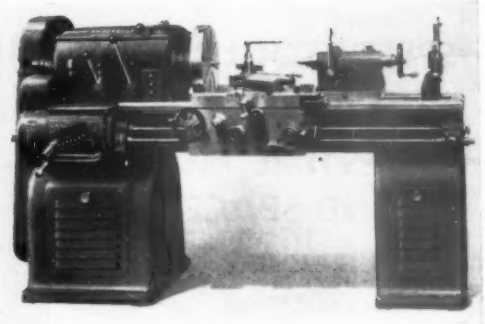
TOLEDO

April 9, 1940—Dinner 6:30 P. M., Crystal Room, Hotel Commodore Perry. Installation dinner.

TWIN CITY

April 10, 1940—Dinner 6:30 P.M., Dunwoody Institute.
An interesting program is being arranged.

NEW BRADFORD LATHE



MADE IN 12" — 14" — 16" SIZES

Bulletin No. 246

The Bradford Machine Tool Co.

CINCINNATI OHIO
Established 1840
Dealers Wanted in Some Territories.

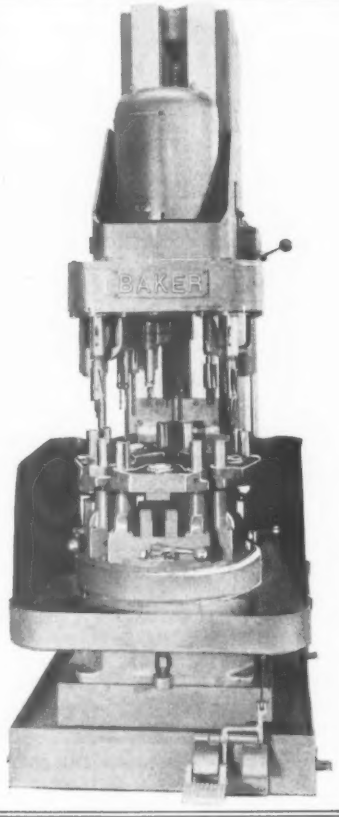
TEE SLOT BOLTS

FOR USE ON PLANERS, BORING MILLS, MILLING MACHINES OR OTHER MACHINES WITH SLOTTED TABLES

THESE bolts are manufactured in the same factory as the well-known "O K System of Inserted-Blade Metal Cutting Tools," and with the same relative care. They are forged of special medium carbon steel, heat treated for maximum toughness. The heads are milled accurately to size. With each bolt is furnished an O K nut of special design, in which nut and washer are incorporated into one unit. Having nut and washer integral eliminates time which is often wasted trying to keep tabs on separate washers. This flanged nut is made of the same tough steel as the bolt itself.

"O K" Tee Slot Bolts may be obtained in any length, from 2" long to 24". A circular completely describing and pricing the line will be sent you on request.

THE O K TOOL CO.
Shelton, Conn.



ESCO
DRILL JIGS

- INCREASED PRODUCTION
- GREATER PRECISION
- POSITIVE LOCKING
- QUICK CLAMPING
- LOWER COSTS

ESCO ENGINEERING & SALES, INC.
4855 FOURTH AVENUE DETROIT, MICH.

"These 'MODERN' COLLETS Sure Do the Job!"

. . . . and that universal expression of satisfaction is also applied by production men to all other "Modern Products"—feed fingers . . . collet and pusher tubes . . . chucking fingers . . . alloy steel cams . . . equalizing finger holders . . . and all other perishable parts and tools for screw machines. They're all designed and manufactured to give better performance at minimum cost.

Write for Our New Complete Catalog.

MODERN COLLET and MACHINE CO.
397 Salliotte Street—Ecorse, Mich.

Industrial Relations Committee A.S.T.E.

PERSONAL SERVICE FOR MEMBERS

SITUATIONS AVAILABLE

Wanted a man who has had a number of years practical experience in the design of cutting tools for work in Detroit, Michigan.

Men experienced on four slide machines and progressive dies, or small automatic and semi-automatic machines, location in Northwestern Pennsylvania. For further information call Tyler 5-0145 or write to American Society of Tool Engineers, 2567 West Grand Boulevard, Detroit.

SITUATIONS WANTED

Tool Designer with eleven years' experience on jigs, fixtures, dies, and special production machinery. Will work anywhere in U.S.A. prefers permanent employment, and a chance for future advancement.

Machine Designer with eighteen years' experience is seeking secure employment.

Man with twenty years' experience which includes machine shop superintendent, and production superintendent work is desirous of obtaining supervisor position.

Man with seventeen years' experience which includes tool designing, tool design supervising, industrial engineering and plant superintendent work, available for supervisory work.

Sales engineer—experienced on machine tools, small tools and materials for industrials in the New York Metropolitan area. Technical graduate with practical engineering background. Interested in high-grade products requiring engineering and sales ability.

Man with fifteen years' experience covering tool design, tool planning, and supervisory work seeking sales engineering work.

Man with 27 years' experience which includes toolmaking, foremanship, special field representative, and fifteen years' of Sales Engineering work, available for work as sales engineer.

For further information call Tyler 5-0145 or write to American Society of Tool Engineers, 2567 West Grand Boulevard, Detroit, Michigan.

CLASSIFIED ADVERTISEMENTS

WANTED—By Midwest plant experienced tool room foreman. Prefer man with automobile transmission experience. In replying, give full details as to experience, references, age, technical education, if any. Box 709—THE TOOL ENGINEER.

KNU-SINE TOGGLE CLAMPS

Many large plants now standardize on these quick-acting clamps for holding parts in dies, jigs and fixtures. Send now for 16-page catalog. Hundreds of possible uses.

PRICES

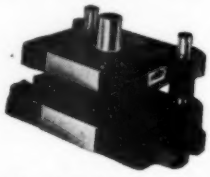
KV-110	$3.40	Each NET
KV-250	2.95	
KV-220	2.12	
KV-210	2.34	
KV-200	1.70	
KV-190	1.70	

KNU-VISE INCORP.
2895 W. Grand Blvd., Detroit, Mich.

USE TOOLS IN GOOD CONDITION TO SLICE YOURSELF A BIGGER PIECE OF PROFIT.

NATIONAL TOOL SALVAGE CO.
3816 Beaubien St., Detroit

DANLY PRECISION DIE SETS



Danly All-Steel Sets
Danly Commercial Sets
Danly Die Makers' Supplies

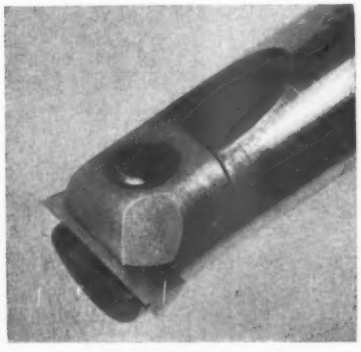
DANLY SERVICE

9 Danly Warehouses Provide 24-Hour Service for 85% of All Metal Fabricating Plants

Danly Machine Specialties, Inc.

2122 South 52nd Avenue, Chicago, Ill.
513 East Buffalo Street, Milwaukee, Wis.
Long Island City, N. Y., 36-12 34th Street
Dayton, Ohio, 990 E. Monument Avenue
Detroit, Michigan, 1549 Temple Avenue
Rochester, N. Y., 16 Commercial Street
Cleveland, Ohio, 1745 Rockwell Avenue
Philadelphia, Pa., 3913 North Broad Street
Ducommun Metals & Supply Co., P.O. Box, 310 Arcade Station, Los Angeles, Cal. 656-676 Townsend St., San Francisco, Cal.

DANLY DIE MAKERS' SUPPLIES



The new **EVEREDE BORING BAR** is the only bar on the market having the economical triangular bit. The design of this boring bar permits the use of a larger diameter than formerly used, due to having the bit cut in front, making room for the bar. This design spells rigidity, making higher boring speeds and heavier cuts possible.

The **EVEREDE BORING BARS** are made of the finest heat treated nickel steel; and each bar comes equipped with six high speed steel triangular bits. In addition, this is the only boring bar that allows the use of a solid Stellite or carbide tool bit. This is accomplished by clamping the bit on the "V" type grip, which holds it firmly without danger of breakage.

Send for descriptive folder.

EVEREDE TOOL CO.
Willis Stulson
184 N. WACKER DRIVE, CHICAGO
Representatives in principal cities

Four Standard Fixtures
Tooled to Drill One Inch Hole
Through Center of Cluster Gear
Lower Adapter Locates and Grips Part

TOOLING ECONOMY
FOR HIGH PRODUCTION

SWARTZ FIXTURES MOUNTED ON GANG DRILL ELIMINATE COMPLICATED, HIGHLY SPECIAL FIXTURE DESIGNS

RAPID
POSITIVE
CLAMPING

SWARTZ TOOL PRODUCTS CO., INC.

5259 Western Avenue — ASK FOR CATALOG 238C — Detroit, Michigan

Represented by

Cleveland—J. W. Mull, Jr.
Indianapolis—J. W. Mull, Jr.
Milwaukee—Geo. M. Wolff, Inc.
Tulsa, Okla.—Brammer Machine & Tool Service Co., Inc.
Chicago—Ernie Johnson
Canada—Hi-Speed Tools, Ltd., Galt, Ont.
St. Louis—Mill Supply & Mach. Co.
Oneida, N. Y.—W. F. Himmelsbach
Pittsburgh—J. W. Mull, Jr.
Toledo—J. W. Mull, Jr.
Philadelphia, Pa.—Morgan Tool & Equipment Co.

"ROCKWELL"
HARDNESS TESTER
For Internal Testing
As no plane can be better than its engine cylinders, the leading engine builders use our internal type tester for cylinder inspection. Made in Normal and "Superficial" Types.
WILSON
MECHANICAL INSTRUMENT CO., INC.
Concord Avenue, N. Y. City

NEW ALL-HELICAL GEARED 4-SPEED SCHULTES UNIT

Instant Reversibility

Features:

For punch presses, lathes, shapers, milling machines, drill presses, etc. One lever synchromesh shift controls 4 speeds.
Instant reversibility with all 4 speeds. Adapted to V-belt, flat-belt, chain or direct drive.
Hand wheel permits rotation of machine spindle for set-up work with complete safety.
Cradle adjustment permits the unit to be revolved to any desired position . . . placing gear shift lever where most convenient.

Write for illustrated folder

WESTLOF TOOL AND DIE CO.
429 BELLEVUE AVE. — DETROIT, MICH.

VISUAL MACHINE FINISH

(Continued from Page 72)

follows:

CM Machine Finish Standards

Rough (.015" feed & up) 1/16"-⅛" Rad. Tool.
Tolerances fractional

f_1 General Use
- a. Clearance
- b. Appearance
- c. True up
- d. Break scale (CSTGS)

Semi-Finish (.005"-.015" feed) 1/32"-1/16" Rad. Tool.
Total Tolerances—.010"

f_2 General Use
- a. Turn for Grind
- b. Close Clearance
- c. Appearance

Finish (.002"-.005" Feed) 1/32"-1/16" Rad. Tool.
Total Tolerance—.003"

f_3 General Use
- a. Press Fits (not ground)
- b. Stationary Fits (not ground)

Fine Finish (.001-.002" Feed)
Total Tolerance—.003

f_4 General Use
- a. Substitute for ground finish
- b. File and polish

CM Ground Surface Standards

Rough Grind (36-40 Grit Wheel) 1 Cut
Tolerances—.002"

G_1 General Use
- a. Press Fits (green)
- b. Stationary Fits (green)
- c. Green Grind
- d. Appearance

Finish Grind (60 Grit Wheel) 1 Cut
Total Tolerances—.0015"

G_2 General Use
- a. Running Fits (Hard or Green)
- b. Press Fits (Hard)

Fine Finish (100-200 Grit Wheel)

G_3 General Use
- a. Tools and Gauges
- b. Extremely Fine Finish

Ultra Finish (500 Grit Wheel)

G_4 General Use
- a. Fine Gauge Work
- b. Lapping and Honing

The foregoing outline appears in all copies of the engineering standards books and tool standards books in the organization. In addition to this there are sample boards in the following locations: Engineering Dept., Time & Methods Dept. (rate setting, time study, and methods analysis), Machine Shop and Inspection Dept. There appears under each standard finish sample the nomenclature symbol, description, specifications, and general uses of each finish. The latter serves particularly as a guide for the engineering department.

Furthermore it will be noticed that the first two turned finish samples "f_1 rough" and "f_2 semi-finish" are divided into four sections each. The purpose of this is to show the appearance of maximum and minimum feeds or wheel grits, as well as intermediate values covered by that particular standard. Likewise, the last two turned samples "f_3" and "f_4" have three sections and two sections respectively. Similarly grinder finishes "G_1" and "G_2" have two sections. Each aforementioned section shows the following, while "G_3" and "G_4" show one condition only:

f_1 rough turn — .015"-.025"-.032"-.050" per rev.
f_2 semi-finish turn — .005" - .008" - .010"-.012" per rev.
f_3 finish turn—.002"-.003"-.004" per rev.
f_4 fine finish turn—.001"-.0015" per rev.
G_1 rough grind—30 grit and 40 grit wheels
G_2 fine finish grind—100 grit and 200 grit wheels

The system as outlined above operates on a visual comparison basis. It places visual comparison on a more accurate and consistent basis and the "yardsticks" used are preserved for future and all time comparisons. It is not elaborate, as a matter of fact, for some plants it may be considered too simple. However, elaborations along the same general lines can easily be made. In the writer's opinion over-elaboration is a thing to steer away from. The use of a couple additional intermediate grinder finishes, coupled with an exact measurement or detection arrangement, such as profilometer, might be worth serious consideration in some plants.

This system works. It greatly reduces arguments all along the line and reduces costs as well.

AMPCO METAL
IS OFTEN THE ANSWER

IF you require a non-ferrous alloy that provides the utmost in wear resistance — tensile strength — corrosion resistance . . . then you have a job for Ampco Metal.

Time and again — for hundreds of manufacturers, Ampco Metal has proved its value in a wide variety of applications, ranging from cams, shifters, nuts, gears, bushings and bearings, to forming and drawing dies and acid resistant equipment. Time and again it has proved its ability to outlast other alloys in difficult services — that it can actually outwear hardened steel.

In some one of its six grades Ampco Metal can probably solve a problem for you — why not check with us.

AMPCO METAL, INC., Dept. TE-4, Milwaukee, Wisconsin

"The Metal without an Equal"

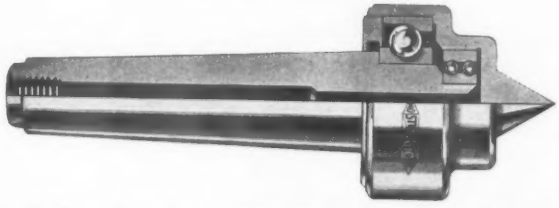
AMPCO METAL

. . . distinguished by this mark.

Mention "The Tool Engineer" to advertisers

THE STURDIMATIC

High Speed Heavy Duty
for
LATHES—GRINDERS—MILLING MACHINES, Etc.



1. **Does not distort or damage center hole for subsequent operations.**
2. **The Sturdimatic Center is close to the work, thereby eliminating excessive overhang.**
3. **Large radial and thrust bearings insure accuracy and long life under heavy duty.**
4. **Automatic compensation for expansion, shock, and wear.**
5. **Ample tool clearance.**

Try a Sturdimatic live center for 30 days. If it does not meet with your entire satisfaction return it without further obligation.

Send for catalog

THE STURDIMATIC TOOL CO.
Columbia 4512 **5218 Third Avenue, DETROIT**

Gaging Precision By TOUCH Is Only Approximation Compared to VISION

The sense of **feeling** or of **touch** as applied to fixed gages when used to determine the accuracy of specified sizes on machine parts, depends upon the sensitivity of the inspector and varies with each individual.

But, a visible indicating hand, moving over widely spaced dial graduations, is something which can be seen with the same degree of accuracy by **anybody.**

This fact is one of the strongest reasons for using Dial Indicators even for comparatively large tolerances. Send for catalog.

FEDERAL PRODUCTS CORP., 1144 EDDY ST., PROVIDENCE, R. I.

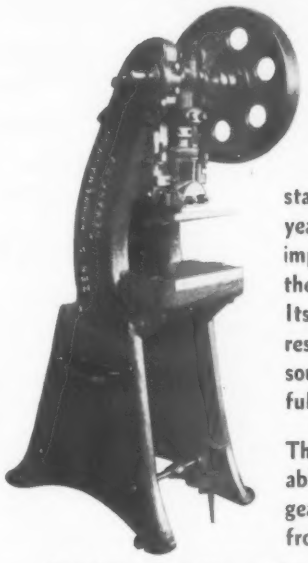
FEDERAL

PRECISION MEASURING INSTRUMENTS

Chicago · Cleveland · Detroit · West Hartford · Muncie
New York · Philadelphia · Pittsburgh · Rochester

Reclinable

POWER PRESSES



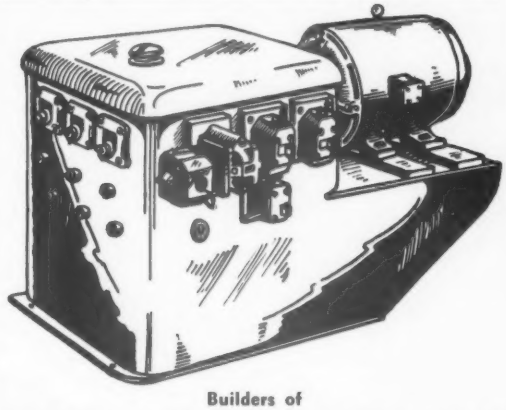
This press has long been considered the most suitable and favored type for general stamping work. Its features have been standard for a number of years, but many important improvements in details make the latest model outstanding. Its high performance is the result of thorough research, sound engineering and careful designing.

The Type 36 Press is available either plain or back geared, and the models range from 4 to 100 tons capacity.

Complete information on this and other Z & H presses will be sent on request.

ZEH & HAHNEMANN CO.
192 VANDERPOOL STREET, NEWARK, N. J.

HY-MAC



Builders of
SPECIAL HYDRAULIC MACHINERY
Hydraulic Power Units
Hydraulic Conversions of Machinery

Write for further information.

HYDRAULIC MACHINERY, INC.
9369 AMERICAN AVE. PHONE TY. 4-2362
Detroit, Mich.

DRILL AND PILOT BRUSHING FRICTIONLESS ROTARY

For core drilling, T.C. and high speed boring, turret tool piloting, etc. Won't stick or clog. Dust proof as a watch.

Write for details.

GIERN & ANHOLTT TOOL COMPANY

1313 Mt. Elliott Ave. DETROIT, MICH.

Just What You Have Been Wanting—An Economical Live Ball and Roller Bearing Center

For Lathes, Hand Screw Machines, Grinders, and Mills

1. Simplicity and sturdiness adapt this center to heavy duty with extra long life.
2. Sufficient bearings for radial, thrust, and alignment loads resulting in 50% more radial load than the average live center.
3. Large spindle, small head, and short overhang spells rigidity—result, no chatter.
4. Has special oil seal to retain lubricant and resist foreign matter.

A folder giving prices and complete detail will be mailed to you just for the asking.

A lower first and last cost. Let us prove it by sending you one today for a ten day trial, and if not satisfactory in every way return it.

MOTOR TOOL MFG. CO.
12281 Turner Ave., Detroit, Mich.

SHELDON Back Geared Screw Cutting PRECISION LATHES

Made in three sizes (10", 11" or 12" swing) the SHELDON Lathe is just the lathe for your experimental department, repair department or tool room. It is also ideally suited for the manufacturing departments . . . fitted with special tools it is a money maker on second operation work. It can be furnished in many styles and combinations.

No. 1136 WFCQ—11" Swing, 36" between centers, 56" hand scraped semi-steel bed with 2 V-ways and 2 flat ways. Large, hardened steel spindles, and ground all over. Hand Collet capacity ¾". Phosphor Bronze Bearings. Full Quick Change Gear Box. Worm Feed Apron with Power Cross Feed. Thread Chasing Dial. With floor legs, Headstock Motor Drive Attachment (less motor) $355 F.O.B. Factory.

SHELDON LATHES, though low in price, are quality machine tools in every detail . . . in design, materials, workmanship and in features.

SHELDON MACHINE CO., Inc.
1519 North Kilbourn Ave. CHICAGO, U.S.A.

"Ultra" Smooth

INTERNAL SURFACES IN **BALL BEARING HOUSINGS** AND SHALLOW BOTTOMED OR SHOULDERED HOLES are now a certainty with this contribution to—

Profitable Production

The Expansible Bearingizer
Completely automatic in action; ruggedly constructed; accurate and extremely sensitive.

A real producer and time saver.

Send your drawings for recommendations without obligation.

"HOLE" ENGINEERING SERVICE
307 Boulevard Bldg.
DETROIT MICH.

GORHAM

CUTTING TOOLS OF QUALITY

Milling Cutters
Slitting Saws
Reamers
Tool Bits

and

SPECIAL TOOLS TO YOUR REQUIREMENTS AND SPECIFICATIONS

GORHAM TOOL COMPANY
14400 Woodrow Wilson
DETROIT

KOEBELITE DIAMOND TOOLS

★

Deliver a Known Quantity—and Quality—of Service

★

KOEBEL DIAMOND TOOL CO.
DETROIT

CERROMATRIX saved 500 hours in making this die

Urbana Tool & Die Co. used CERROMATRIX to space and hold the punches in this motor lamination die for Hobart Mfg. Co., saving 500 hours in making it. The die has already produced over 2,000,000 blanks and looks as good as ever. Mr. Dodson, Hobart's Chief Tool Engineer, recently wrote a prospective user of Cerromatrix: "You need have no fear of the outcome nor the ultimate life of the die. The Cerromatrix will still be there doing its job when the die is worn out."

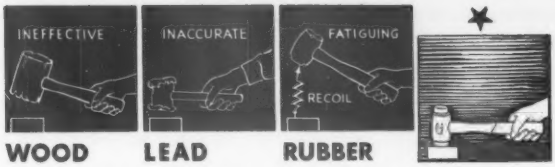
This low-temperature-melting alloy expands slightly on solidification and is widely used for locating punch and die parts permanently; for anchoring machine parts without expensive drive fits and for many other uses.

Send for new free Cerromatrix Manual.

CERRO DE PASCO COPPER CORPORATION

40 WALL STREET • • NEW YORK, N. Y.

BRITISH ASSOCIATES: MINING & CHEMICAL PRODUCTS LTD., LONDON, ENGLAND
CANADIAN DISTRIBUTORS: DOMINION MERCHANTS LTD., MONTREAL, CANADA



WOOD — *makes a clumsy tool that will split and crack.*

LEAD — *metal heads have edges that turn, break and fly off.*

RUBBER — *makes a bouncing head that chips and smears.*

★ **RAWHIDE** — *heads and faces stay accurate, absorb shock and wear longest.*

★ **Chicago Rawhide Hammers and Mallets are the tools for striking hard accurate blows safely on any surface that must not be cracked, battered or marred. The tough Java Water Buffalo hide, coiled, compressed and treated for long life will not split, break or even dent, and has resilience to absorb rebound for easier, accurate blows.**

These hammers and mallets with genuine rawhide heads are quality tools for thrifty mechanics. Sold by industrial supply houses everywhere.

These replaceable faces of genuine rawhide "stay put" in the indestructible malleable iron heads of Chicago Rawhide hammers for thousands of accurate blows. No shifting —no separating—always true.

CHICAGO Rawhide MFG. CO.
1393 ELSTON AVE · CHICAGO · U·S·A·

NEW and INFORMATIVE

CATALOG NO. 3 OF

KENNAMETAL

Tools and Blanks

Completely illustrates and describes 20 standard style KENNAMETAL tools for machining steel and other metals. Includes the new Styles 19 and 20 tools for shapers and planers, as well as KENNAMETAL-tipped Milling Cutters. Complete specifications given for each style of tool.

A Practical Guide for the Care and Use of Carbide-Tipped Tools

The new catalog furnishes detailed instructions on how to grind and braze KENNAMETAL tools, how to calculate H. P. required for a given cut, and how to grind chip breaker grooves for safe disposal of continuous steel chips. A free copy of the new KENNAMETAL Catalog No. 3 will be mailed to any plant operating official or other executive requesting it on his company letterhead.

McKENNA METALS Co.
600 LLOYD AVENUE
LATROBE, PENNSYLVANIA, U.S.A.

Columbia TOOL STEEL

SPECIALISTS—

Columbia's workmen, making tool steel exclusively, are all specialists who take pride in their work.

Users report new standards of accuracy and performance.

It pays to use Good Tool Steel.

COLUMBIA TOOL STEEL COMPANY
ARTHUR T. CLARAGE, PRESIDENT
GENERAL OFFICE AND WORKS
520 EAST 14TH STREET • CHICAGO HEIGHTS, ILL.

BARNES
HYDRAULICS

TYPE 75 HYDRAULIC UNIT COMPLETE WITH NECESSARY VALVES. READY TO INSTALL. FOR RAPID TRAVERSING AND FEEDING MACHINE ELEMENTS.

HYDRAULIC CIRCUITS ENGINEERED TO MEET INDIVIDUAL REQUIREMENTS

GEAR AND PISTON PUMPS
FEED AND TRAVERSE UNITS
CONTROL VALVES

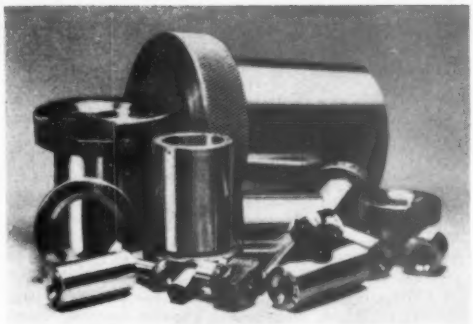
John S. Barnes Corporation

DETROIT SALES OFFICE
503 NEW CENTER BLDG.
TR-1-1706

MAIN OFFICE
AND FACTORY
ROCKFORD, ILL.

ACME

DRILL JIG BUSHINGS



Two complete standards (A.S.A. and Acme) allow wide selection from stock and reduce your need for special bushings.

Write for Catalog.

Precision Parts Made to Order
Lapped Fits a Specialty

ACME INDUSTRIAL CO.
208 N. Laflin St., Chicago, Ill.
MONroe 4122

TANNEWITZ DI-SAW
Saves an Average of $4.80 Each Hour It's Used

Inside and outside cuts on dies, shoes, templets and endless other jobs can be done in a small fraction of the time required by former methods. Saws, files and polishes. A highly developed, large capacity machine.

Write for literature.

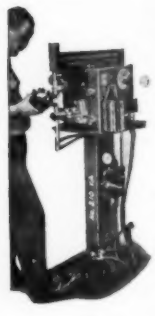
THE TANNEWITZ WORKS
GRAND RAPIDS • MICHIGAN

YOU'LL SAVE TIME

AND TROUBLE . . . BY SPECIFYING NATIONAL TWIST DRILLS, HOBS, REAMERS . . . MILLING CUTTERS, *Special* TOOLS

NATIONAL TWIST DRILL AND TOOL CO.
DETROIT, U. S. A.

Tap and Die Division, WINTER BROS. CO., Wrentham, Mass.
Factory Branches: New York, Chicago, Philadelphia, Cleveland
Distributors in Principal Cities



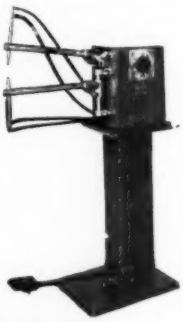
MR. ENGINEER

You will be interested in our NEW VERTICAL PRESS TYPE WELDERS for precision work. CHAS. EISLER has over 50,000 SPOT WELDERS in daily use. Welders from ¼ to 500 KVA.

We also make a full line of standard and special TRANSFORMERS.

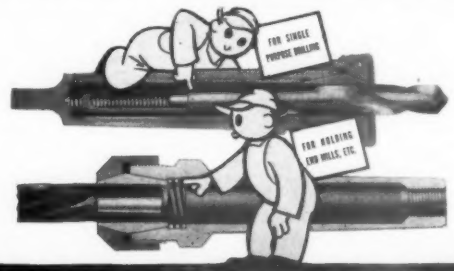
Please write to us for more information.

A. C. Arc Welders from 100 to 400 amps.



EISLER ENGINEERING COMPANY
CHAS. EISLER, Pres.
744 So. 13th St. (Near Avon Ave.) Newark, New Jersey

TWO GREAT COLLET CHUCKS



UNIVERSAL ENGINEERING CO.
FRANKENMUTH, MICHIGAN

Give Taps and Reamers "A Break"!

FLOATS RADIALLY

Drive Them WITH THE ZIEGLER

ROLLER DRIVE

Floating Holder

"It Always Floats"

Compensates for spindle misalignment, eliminating oversized or bell-mouthed holes.

Furnished with male or female taper, straight, threaded or special shanks to fit any machine used for tapping or reaming.

W. M. ZIEGLER TOOL CO.
1920 Twelfth Street DETROIT

BOYAR-SCHULTZ PROFILE GRINDER
BENCH MODEL NO. 1

This machine tool didn't "just happen," nor was it developed as a machine that "would sell." It was created by Tool Engineers who needed just such a tool for economically grinding and fitting irregular surfaces, difficult contours and odd shapes in their daily work of making dies, punches, cams and templates; for doing quickly, work that had always taken many hours of labor.

Boyar-Schultz Profile Grinder No. 1 performs at high speed and with accuracy that is impossible with hand grinding.

Write for circular fully describing this useful Machine Tool.

Boyar-Schultz Corporation
2116 Walnut Street Chicago, Illinois

GAMMONS OF *Manchester*

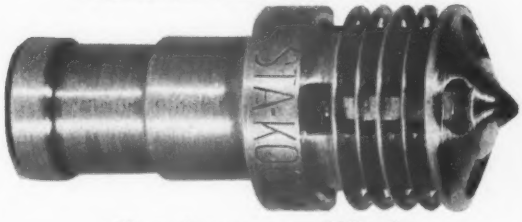
PRODUCTION TOOLS

ORIGINATORS AND MANUFACTURERS OF HELICAL FLUTED TAPER PIN REAMERS

THE GAMMONS-HOLMAN CO., MANCHESTER CONNECTICUT

JK SMIT SONS

Precision Diamond Tools



For Accurate Work

The illustration above shows the effective design of the STA-KOOL Diamond Tool Holder.

STA-KOOL—Dissipates Heat
Prolongs Life
Reduces Cost

Write for further information about STA-KOOL — "Tool Engineered" for precision.

J. K. SMIT & SONS, INC.
157 Chambers Street, New York, N.Y.

968 Farmington Ave., Hartford, Conn. **Law and Finance Bldg. Pittsburgh, Pa.**

Detroit — Chicago — Seattle — Toronto

VICTOR'S BARGAINS

IN NEW HIGH SPEED STRAIGHT SHANK TWIST DRILLS

JOBBERS OR SHORT LENGTH

Size Inches	Our Price Net Per Dozen High Speed	Length Overall Inches
1/16	$ 1.46	2 1/2
5/64	1.52	2 5/8
3/32	1.56	2 3/4
7/64	1.66	2 7/8
1/8	1.76	3
9/64	1.90	3 1/8
5/32	2.05	3 1/4
11/64	2.19	3 3/8
3/16	2.36	3 1/2
13/64	2.56	3 5/8
7/32	2.79	3 3/4
15/64	3.05	3 7/8
1/4	3.29	4
17/64	3.65	4 1/8
9/32	4.01	4 1/4
19/64	4.38	4 3/8
5/16	4.75	4 1/2
21/64	5.23	4 5/8
11/32	5.72	4 3/4
23/64	6.21	4 7/8
3/8	6.70	5
25/64	7.29	5 1/8
13/32	7.91	5 1/4
27/64	8.50	5 3/8
7/16	9.12	5 1/2
29/64	9.72	5 5/8
15/32	10.34	5 3/4
31/64	11.07	5 7/8
1/2	11.79	6

In assorted lots of 12 dozen a discount of 10% will be given. Will take orders less than a dozen.

SEND FOR OUR NEW 1939-40 GENERAL CATALOGUE

Satisfaction Guaranteed

VICTOR MACHINERY EXCHANGE, Inc.

251 Centre Street, New York, N. Y.

NOW!! **LIGHT BEVEL "SAFETY" LETTERS and FIGURES**

These stamps are 35% lighter and 25% stronger than ordinary heavy bevel stamps. They are made of our patented safety steel which will not spall, mushroom or bend. Light bevel stamps are guaranteed to give as much service as heavy bevel stamps made of other steel.

Prices are 20 to 30% less than our Heavy Bevel List.

Write for Prices and Literature

M. E. CUNNINGHAM CO.

169 EAST CARSON ST. PITTSBURGH, PA.

Advertisers' Index

Abrasive Company 80
Acme Industrial Co. 84
Ajax Steel & Forge Co. 75
Ampco Metal, Inc. 80
Apex Machine & Tool Co., The 73
Armstrong-Blum Mfg. Co. 70
Armstrong Bros. Tool Co. 73

Barber-Colman Co. 39
Barnes Corp., John S. 84
Besly & Co., Charles H. 67
Blanchard Machine Co. 48
Boyar-Schultz Corp. 85
Bradford Machine Tool Co., The 76
Bristol Co., The 68
Brown & Sharpe Mfg. Co. 87

Carboloy Company, Inc. 43
Carpenter Steel Co., The 51
Cerro de Pasco Copper Corp. 83
Chicago Rawhide Mfg. Co. .. 83
Columbia Tool Steel Co. 83
Continental Machines, Inc. ... 46
Crucible Steel Co. 41
Cunningham Co., M. E. 86
Cushman Chuck Co., The 40

Danly Machine Specialties, Inc. 78
Davis Boring Tool Division ... 56
Delta Mfg. Co. 61
Detroit Power Screwdriver Co. 73

Eclipse Counterbore Co. 74
Eisler Engineering Co. 84
Esco Engineering & Sales, Inc. 77
Everede Tool Co. 78
Ex-Cell-O Corp. 57

Federal Products Corp. 81
Frick-Gallagher Mfg. Co., The 75

Gammons-Holman Co., The ... 85
Giern & Anholtt Tool Co., Inc. 82
Gisholt Machine Co. 37
Gorham Tool Co. 82
Gorton Machine Co., Geo. 42
Greenfield Tap & Die Corp.... 8

Hannifin Mfg. Co. 6
Hardinge Brothers, Inc. 1
Haskins Co., R. G. 76
Henry & Wright Mfg. Co., The 62
Hole Engineering Service 82
Holo-Krome Screw Corp., The 5
Hydraulic Machinery, Inc. 81

Illinois Tool Works 33
Internat'l Nickel Co. Inc., The 35

Jones & Lamson Machine Co. 45

Kearney & Trecker Corp. 65
Knu-Vise, Inc. 78
Koebel Diamond Tool Co. 82

Landis Tool Co. 69
LeBlond Machine Tool Co., The R. K. 88
Lewthwaite Machine Co., T. H. 72
Logansport Machine, Inc. 63
Lufkin Rule Co., The 66

McKenna Metals Co. 83
Modern Collett & Machine Co. 78
Motor Tool Mfg. Co. 82

Nat'l Broach & Machine Co... 53
Nat'l Tool Salvage Co. 78
Nat'l Twist Drill & Tool Co... 84

OK Tool Co., The 77
Oxalid Corp. 74

Parker-Kalon Corp. 58, 59
Potter & Johnston Machine Co. 55
Pratt & Whitney Div. 2

Racine Tool & Machine Co.... 72
Ross Operating Valve Co. ... 64
Ruthman Machinery Co., The.. 70

Scully-Jones & Co. 47
Sellers & Co., Inc., William .. 71
Sheldon Machine Co., Inc. 82
Smit & Sons, Inc., J. K. 85
South Bend Lathe Works 52
Standard Gage Co., Inc. 3
Stanley Works, The 50
Starrett Co., The L. S. 31
Stuart Oil Co., Ltd., D. A..... 54
Sturdimatic Tool Co., The 81
Sundstrand Machine Tool Co. 44
Sunnen Products Co. 49
Swartz Tool Products Co., Inc. 79

Tannewitz Works, The 84

Universal Engineering Co...84, 86

Victor Machinery Exch., Inc... 86

Warner & Swasey Co. 29
Westlof Tool & Die Co. 79
Wilson Mech. Instr. Co. Inc... 79

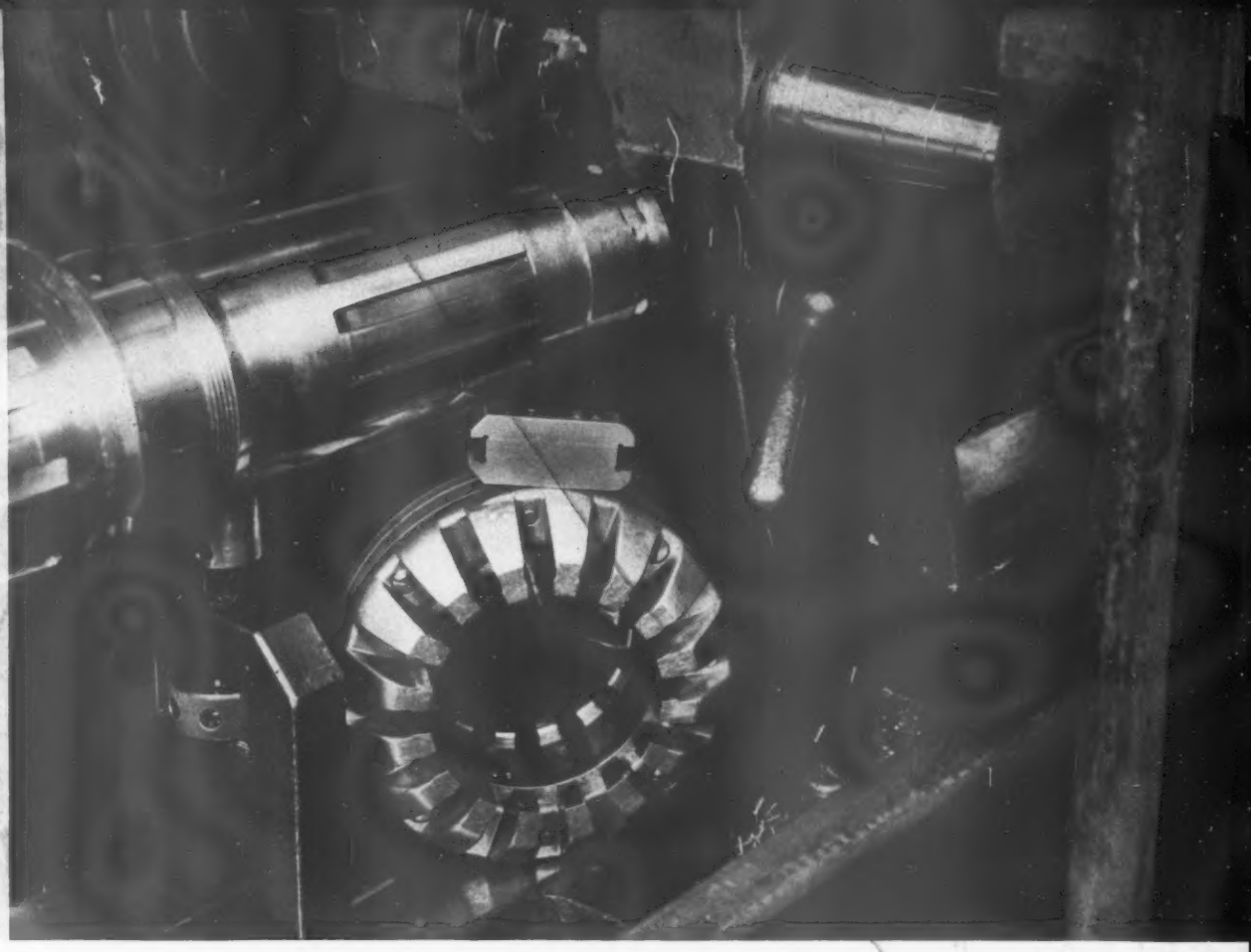
Zeh & Hahnemann Co. 81
Ziegler Tool Co., W. M. 85

Classified Advertising.....78

SPECIFY STANDARD A.S.A. DRILL BUSHINGS

UNIVERSAL ENGINEERING CO.

FRANKENMUTH, MICHIGAN



Get New Economies through **Climb Milling**

—Another MODERN feature of the Brown & Sharpe *Electrically Controlled* Nos. 10 and 12 Plain Milling Machines . . . the Backlash Eliminator — permits the full advantages of climb milling, especially on work difficult to hold—as well as allowing increased feeds with better finish and longer cutter life.

B·S

Investigate the advantages of these profitable machines for Your work. Write for complete details, Brown & Sharpe Mfg. Co., Providence, R. I., U. S. A.

BROWN & SHARPE

22

7H 1/5-5V

WE'VE NEVER WORN IT AND WE NEVER WILL..

It's not difficult for men to lose the common touch when business rolls to a flattering tide. At such times the lofty attitude, the high hat is so easy to don.

It is our earnest hope that throughout the far-flung LeBlond area of service, that LeBlond men and LeBlond customers will not forget that these are abnormal times and that the continuance of friendly understanding and respect is most to be desired.

Today -- while LeBlond is bending every facility to the service of American Industry -- who can know how far the present pace will extend?

It behooves us, therefore, to dismiss the temptation to indulge in self satisfaction, and seek rather to humbly deserve our present privilege of service . . . to be worthy in every way of our responsibilities.

THE R. K. LeBLOND MACHINE TOOL CO.
CINCINNATI, OHIO